AN OVERVIEW OF THE NATION'S WEATHER SATELLITE PROGRAMS AND POLICIES

JOINT HEARING

BEFORE THE

SUBCOMMITTEE ON ENVIRONMENT &
SUBCOMMITTEE ON OVERSIGHT

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

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CONTENTS

December 10, 2015

AN OVERVIEW OF THE NATION'S WEATHER SATELLITE PROGRAMS AND POLICIES

THURSDAY, DECEMBER 10, 2015

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENVIRONMENT AND
SUBCOMMITTEE ON OVERSIGHT
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Subcommittees met, pursuant to call, at 10:10 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Jim Bridenstine [Chairman of the Subcommittee on Environment] presiding.

LAMAR S. SMITH, Texas
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Subcommittees on Environment and Oversight

An Overview of the Nation's Weather Satellite Programs and Policies

Thursday, December 10, 2015
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Witnesses

Dr. Stephen Volz, Assistant Administrator, National Environmental Satellite, Data, and Information Services, National Oceanic and Atmospheric Administration

Mr. David Powner, Director, Information Technology Management Issues, Government Accountability Office

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON ENVIRONMENT
SUBCOMMITTEE ON OVERSIGHT

HEARING CHARTER

An Overview of the Nation's Weather Satellite Programs and Policies

Thursday, December 10, 2015
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Purpose

The Subcommittees on Environment and Oversight will hold a joint hearing titled *An Overview of the Nation's Weather Satellite Programs and Policies* at 10:00 a.m. on December 10th in room 2318 of the Rayburn House Office Building. Witnesses will provide an update of the operations and development of National Oceanic and Atmospheric Administration's (NOAA) polar-orbiting and geostationary weather satellite programs and discuss new policies and procedures for incorporating commercial space data to aid weather forecasting.

Witnesses

- **Dr. Stephen Volz,** Assistant Administrator, National Environmental Satellite, Data, and Information Services, National Oceanic and Atmospheric Administration.

- **Mr. David Powner,** Director, Information Technology Management Issues, Government Accountability Office.

Background

Over the last decade, the Committee on Science, Space, and Technology has monitored the troubled development of NOAA's weather satellite programs, which provide vital input to weather forecasts. The largest NOAA programs are the Joint Polar Satellite System (JPSS) and the Geostationary Operational Environmental Satellite System (GOES).

NOAA's satellite systems form the fundamental base for the nation's weather forecasting ability, providing the majority of data used. A report by the National Research Council found that 80% of the data assimilated into numerical weather models comes from satellites.[1] Satellite data is able to significantly enhance forecasting accuracy. For example, in 2010, data from polar-orbiting satellites helped meteorologists predict the arrival of "Snowmageddon" along the East Coast of the United States five days in advance, and early forecasts of Superstorm Sandy's

[1] National Research Council, national Academy of Sciences, "Fair Weather Report: Effective Partnership in Weather and Cliamte Services," 2003, available at: http://www.nap.edu/catalog/10610/fair-weather-effective-partnerships-in-weather-and-climate-services

track were aided by polar-orbiting satellites, according to a study by the European Centre for Medium-Range Weather Forecasts.[2]

Due to a series of management problems, delays, and increased costs over many years for NOAA's satellite programs, the United States now faces a likely gap in satellite coverage and data. Without this data, the ability of American weather models to accurately predict weather events will be greatly diminished.

Historical Context

National Polar-orbiting Operational Environmental Satellite System

In the 1960s, the United States began operating two polar-orbiting meteorological satellite systems: one managed by NOAA and another by the Air Force. Polar-orbiting satellites transverse the globe from pole to pole, with each orbit defined by the time of day they pass over the equator: early morning, late morning, and afternoon. Unlike geostationary weather satellites, which offer persistent coverage over an area, each polar-orbiting satellite makes approximately 14 orbits per day and is able to view the entire Earth's surface twice per day.

In 1994, as part of the Clinton-Gore Administration's Reinventing Government initiative, a Presidential Decision Directive required NOAA and the Department of Defense (DOD) to merge the civilian and military polar-orbiting satellite systems into one program, the National Polar-orbiting Operational Environmental Satellite System (NPOESS). To manage the program, DOD, NOAA, and NASA formed a tri-agency Integrated Program Office. Overall responsibility for the management of the system and satellite operations was assigned to NOAA. The DOD was responsible for acquisition of the sensors, satellite bus, and launch vehicle, while NASA was responsible for facilitating the development and incorporation of new technologies.[3]

By 2009, the life-cycle cost estimate of NPOESS had ballooned to at least $14.9 billion for four new satellites, the first of which was projected to launch in 2014. In June 2009, an Independent Review Team (IRT) determined that the NPOESS program had a low probability of success.[4]

Joint Polar Satellite System

In February 2010, the Office of Science and Technology Policy announced that the program would be split, with NOAA and the DOD creating their own programs, establishing requirements, and transferring existing NPOESS contracts to new programs.[5] Satellites flying in orbits to collect early-morning observations would be developed and launched by DOD, while NOAA's Joint Polar Satellite System would collect observations in the afternoon orbit. These

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[2] NOAA, *Suomi NPP: Improving U.S. Weather Forecast Accuracy from Space*, December 3, 2012, available at: http://www.nesdis.noaa.gov/npp_launch.html; European Centre for Medium-Range Weather Forecasts, "Annual Report: 2012," p.5, available at: http://www.ecmwf.int/publications/annual_report/2012/pdf/Annual-report-2012.pdf

[3] GAO, "Polar-Orbiting Environmental Satellites: Changing Requirements, Technical Issues, and Looming Data Gaps Require Focused Attention," GAO-12-604, June 2012, p.12. Found at: http://www.gao.gov/assets/600/591643.pdf .

[4] NOAA, NESDIS, "Joint Polar Satellite System," Fiscal Year 2011 Budget Highlights," Available at: http://www.corporateservices.noaa.gov/nbo/fy11_budget_highlights/JPSS_Budget_Highlights.pdf

[5] Office of Science and Technology Policy, Restructuring the National Polar-Orbiting Operational Environmental Satellite System, 2010, Available at: http://www.whitehouse.gov/sites/default/files/npoess_decision_fact_sheet_2-1-10.pdf

orbits provide adequate coverage of the Earth during various times of the day and collect information for weather models.

In 2010, NOAA estimated that the life cycle costs of the JPSS program would be approximately $11.9 billion. Though data monitoring requirements for the program had not changed, NOAA's JPSS program office made plans to remove key requirements to keep the program within the prescribed budget. Meanwhile, DOD decided to terminate its program and reassess its requirements.[6]

The following table from GAO compares the planned costs, schedule and scope of NPOESS and JPSS over time.[7]

Figure 1: Temporal Comparison of NPOESS and JPSS[8]

Key area	NPOESS after it was restructured (as of June 2006)	NPOESS prior to being disbanded (as of February 2010)	JPSS program (as of May 2010)	JPSS program (as of June 2012)	JPSS program (as of September 2013)
Life cycle	1995-2026	1995-2026	2010-2024	2010-2028	2010-2025
Estimated life cycle cost	$12.5 billion	$13.95+ billion[a]	$11.9 billion (which includes about $2.9 billion spent through fiscal year 2010 on NPOESS)	$12.9 billion (which includes about $3.3 billion spent through fiscal year 2011 on NPOESS and JPSS)	$11.3 billion (which includes about $4.3 billion spent through fiscal year 2012 on NPOESS and JPSS)
Number of satellites	4 (in addition to S-NPP)	4 (in addition to S-NPP)	2 (in addition to S-NPP)	2 (in addition to S-NPP)	2 (in addition to S-NPP)
Number of orbits	2 (early morning and afternoon; would rely on European satellites for midmorning orbit data)	2 (early morning and afternoon; would rely on European satellites for midmorning orbit data)	1 (afternoon orbit) (DOD and European satellites would provide early and midmorning orbits, respectively)	1 (afternoon orbit) (DOD and European satellites would provide early and midmorning orbits, respectively)	1 (afternoon orbit) (DOD and European satellites would provide early and midmorning orbits, respectively)
Launch schedule	S-NPP by Jan. 2010 First satellite (C1) by Jan. 2013 C2 by Jan. 2016 C3 by Jan. 2018 C4 by Jan. 2020	S-NPP no earlier than Sept. 2011 C1 by March 2014 C2 by May 2016 C3 by Jan. 2018 C4 by Jan. 2020	S-NPP—no earlier than Sept. 2011 JPSS-1 available in 2015 JPSS-2 available in 2018	S-NPP—successfully launched in Oct. 2011 JPSS-1 by March 2017 JPSS-2 by Dec. 2022	S-NPP—successfully launched in Oct. 2011 JPSS-1 by March 2017 JPSS-2 by Dec. 2021
Number of sensors	S-NPP: 4 sensors C1: 6 sensors C2: 2 sensors C3: 6 sensors C4: 2 sensors	S-NPP: 5 sensors C1: 7 sensors[c] C2: 2 sensors C3: 6 sensors C4: 2 sensors	S-NPP: 5 sensors JPSS-1 5 sensors[d] JPSS-2: 5 sensors	S-NPP: 5 sensors JPSS-1: 5 sensors JPSS-2: 5 sensors Free flyer-1 and-2: 1 sensor and 2 user services systems[e]	S-NPP: 5 sensors JPSS-1: 5 sensors JPSS-2: 5 sensors[f] No free flyers[g]

Source: GAO analysis of NOAA, DOD, and triservice data. | GAO-15-47

[a]Although the program baseline was $13.95 billion in February 2010, we estimated in June 2009 that this cost could grow by about $1 billion. In addition, officials from the Executive Office of the President stated that they reviewed life cycle cost estimates from DOD and the NPOESS program office of $15.1 billion and $16.45 billion, respectively.

[b]In May 2008, the NPOESS Executive Committee approved an additional sensor—Total and Spectral Solar Irradiance Sensor—for the C1 satellite.

[c]The five sensors are the Advanced Technology Microwave Sounder, Clouds and the Earth's Radiant Energy System (CERES), Cross-Track Infrared Sounder, Ozone Mapping and Profiler Suite, and Visible Infrared Imaging Radiometer Suite. NOAA committed to finding an alternative spacecraft and launch accommodation for the Total and Spectral Solar Irradiance Sensor, the Advanced Data Collection System, and the Search and Rescue Satellite-Aided Tracking system.

[d]NOAA planned to launch two stand-alone satellites, called free flyer satellites, to accommodate the Total and Spectral Solar Irradiance Sensor, the Advanced Data Collection System, and the Search and Rescue Satellite-Aided Tracking system.

[e]In its fiscal year 2014 budget request, NOAA transferred responsibility for two sensors to NASA—the Radiation Budget Instrument (formerly known as CERES) and OMPS-L and plans to accommodate these sensors on the JPSS-2 satellite as long as they do not impact the likelihood of mission success.

[f]NOAA canceled Free flyer-1 and established Free flyer-2 as a new program outside the JPSS program. This new program, called the Solar Irradiance, Data, and Rescue (SIDAR) mission, is to accommodate the Total and Spectral Solar Irradiance Sensor, the Advanced Data Collection System, and the Search and Rescue Satellite-Aided Tracking system.

By 2011, NOAA and NASA had established separate, but co-located JPSS program offices, each with different roles and responsibilities. NOAA is responsible for programmatic

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[6] GAO-12-604, June 2012, p.12.

[7] GAO, "Polar Weather Satellites: NOAA Needs to Prepare for Near-Term Data Gaps," GAO-15-47, December 2014, p.12. Found at: http://www.gao.gov/assets/670/667581.pdf.

[8] GAO, "Polar Weather Satellites: NOAA Needs to Prepare for Near-Term Data Gaps," GAO-15-47, December 2014, p.12. Found at: http://www.gao.gov/assets/670/667581.pdf.

activities related to the JPSS satellite development, including managing requirements, budgets, and interactions with satellite data users. NASA is responsible for the development and integration of sensors, satellites, and ground systems.

The Suomi National Polar-orbiting Partnership (S-NPP) satellite was launched in October 2011, the first of a new generation of satellites. S-NPP collects remotely-sensed land, ocean, and atmospheric data during the afternoon orbit.

The scheduled launch date for JPSS is currently March 2017.

Geostationary Satellite System

In addition to polar-orbiting satellites, NOAA also operates Geostationary Observational Environmental Satellites (GOES). NOAA's GOES satellites operate from a geosynchronous orbit 22,300 miles above the Earth, which means they orbit the equatorial plane of the Earth at a speed matching the Earth's rotation. This vantage point allows the satellites to essentially 'hover' continuously over one position on the surface of the Earth and serve as a fixed eye on the continental United States though with limited coverage of the Earth's poles.

The GOES system operated by NOAA utilizes two satellites – one fixed on the eastern United States and the other on the western United States. At any given time, the GOES system also includes a third on-orbit 'spare' called into duty either as an emergency back-up to the primary satellites, or naturally sequenced into operations once an older satellite's service has degraded.

The next-generation of the GOES satellites, known as the GOES-R, is currently under development. GOES-R is expected to significantly improve weather data and will be able to transmit that data at faster rates to enhance the quality and timeliness of information to the user.

Life cycle cost estimates for the GOES-R series now stand at $10.86 billion through 2036 – an increase of $3.2 billion over the estimate for a two satellite system in 2007. The first launch of the series has slipped due to issues with various components and NOAA now expects to launch GOES-R in October 2016.

The following table illustrates key changes to the program since August 2006.

Figure 2: Key Changes to the GOES-R Program[9]

	August 2006 (baseline program)	September 2006	November 2007	February 2011	August 2013
Number of satellites	4	2	2	4	4
Instruments	• Advanced Baseline Imager • Geostationary Lightning Mapper • Magnetometer • Space Environmental In-Situ Suite • Solar Imaging Suite (which included the Solar Ultraviolet Imager, and Extreme Ultraviolet/X-Ray Irradiance Sensor) • Hyperspectral Environmental Suite	• Advanced Baseline Imager • Geostationary Lightning Mapper • Magnetometer • Space Environmental In-Situ Suite • Solar Ultraviolet Imager • Extreme Ultraviolet/X-Ray Irradiance Sensor	No change	No change	No change
Number of satellite products	81	68	34 baseline 34 optional	34 baseline 31 optional	34 baseline 31 optional
Life cycle cost estimate (in then-year dollars)	$6.2 billion – $11.4 billion (through 2034)	$7 billion (through 2028)	$7.67 billion (through 2028)	$10.86 billion (through 2038)	$10.86 billion (through 2038)
Estimated launch dates for GOES-R and GOES-S	GOES-R: September 2012 GOES-S: April 2014	GOES-R: September 2012 GOES-S: April 2014	GOES-R December 2014 GOES-S April 2016	GOES-R: October 2015 GOES-S: February 2017	GOES-R: by March 2016 GOES-S: by June 2017

Based on NOAA's fiscal year 2012 budget estimate. $7.64 billion of this cost estimate was for the first two satellites in the series, GOES-R and GOES-S. The cost for the remaining two satellites—GOES-T and GOES-U—was estimated at $3.22 billion.

Program documentation shows that the launch commitment dates were changed to the first quarter of 2016 and the second quarter of 2017, respectively. The launch dates in this chart reflect the latest month in which launch can occur and still meet the launch commitment dates.

Commercial Space Policy

On September 1, 2015, NOAA published a draft Commercial Space Policy.[10] The draft document was open for public review and comment for one month, closing October 1, 2015. The policy establishes "broad principles for the use of commercial space-based approaches for NOAA's observational requirements."[11] The policy also sets up the different responsibilities for NOAA offices and formulates a broad process. NOAA received 15 comments on the draft policy. The Agency is now examining those comments and plans to formulate a final policy later this year, as well as to establish more detailed processes for private-sector companies seeking to provide data to NOAA.

[9] GAO, "Geostationary Weather Satellites: Launch Date Nears, but Remaining Schedule Risks Need to be Addressed," GAO-15-60, December 2014, p.12. Found at: http://www.gao.gov/assets/670/667565.pdf

[10] NOAA, Office of Space Commercialization, "NOAA Releases Draft Commercial Space Policy," September 1, 2015. Available at: http://www.space.commerce.gov/noaa-releases-draft-commercial-space-policy/

[11] NOAA, Draft Commercial Space Policy, September 1, 2015, Available at: http://www.regulations.gov/#!docketDetail;D=NOAA-NMFS-2015-0109

Additional Reading

- Government Accountability Office, "Polar Weather Satellites: NOAA Needs to Prepare for Near-Term Data Gaps," GAO-15-47, January 2015, Available at: http://www.gao.gov/products/GAO-15-47

- Government Accountability Office, "Geostationary Weather Satellites: Launch Date Nears, but Remaining Schedule Risks Need to be Addressed," GAO-15-60, January 2015, Available at: http://www.gao.gov/products/GAO-15-60

- NOAA, Draft Commercial Space Policy, September 1, 2015, Available at: http://www.regulations.gov/#!docketDetail;D=NOAA-NMFS-2015-0109

Chairman BRIDENSTINE. The Subcommittee on the Environment and the Subcommittee on Oversight will come to order.

Without objection, the Chair is authorized to declare a recess of the Subcommittee at any time.

Welcome to today's hearing titled "An Overview of the Nation's Weather Satellite Program and Policies."

I recognize myself for five minutes for an opening statement and then to the Ranking Member as well.

We've had a number of hearings about all kinds of issues related to satellites from the current programs of record to commercial satellites. We've heard testimony about JPSS and GOES–R already once this year, and this is a second opportunity to do so.

Some of the concerns that I have are the delay of the GOES–R satellite program from March of 2016 to October of 2016. Obviously this is a concern for the weather of our country, being able to predict and forecast accurate and timely weather events, critically important infrastructure for the data that feeds our numerical weather models, which keep all of our constituents safe.

So this is a good hearing. We have heard testimony before. Going along with the delay in GOES–R, we have an extension of the life expectancy of some of our current programs, and we have questions about if that is realistic or not. We have seen now NOAA–16 break apart in space over Thanksgiving, and that gives a lot of us concern about maybe it didn't just break apart on itself. I know some have suggested that but something had to occur, whether it was a malfunction on board the satellite, even though it was beyond its lifetime, or it could have been hit by debris. Whatever the case is, it broke apart and now is contributing to more orbital debris, which is a concern.

That being the case, you think about orbital debris, you think about the Suomi NPP satellite that also is coming to the end of its useful life and it's not shielded. It wasn't designed for long-term service. It was designed more for testing and validation. So when you look at the SUOMI–NPP satellite, is it being pelted by debris? Is it at risk? And of course, would that create, you know, a gap as it relates to our polar orbiting satellite programs and the challenges that we've had with JPSS to date as well.

We'd also like to discuss NOAA's Commercial Space Policy, which is a wonderful start to, I think, great opportunities for the future to provide more resiliency and redundancy, disaggregated and distributed architectures that the commercial industry can provide to augment our numerical weather models with data coming from the private sector, and some of the issue that are going on there. And finally, the issue with debris mitigation, I think are critically important not only to NOAA but to national security space and civil space as well, and commercial space.

So I'm looking forward to this hearing, looking forward to the testimony of our witnesses.

[The prepared statement of Chairman Bridenstine follows:]

COMMITTEE ON
SCIENCE, SPACE, & TECHNOLOGY
Lamar Smith, Chairman

For Immediate Release
December 10, 2015

Media Contact: Zachary Kurz
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Statement from Environment Subcommittee Chairman Jim Bridenstine (R-Okla.)
An Overview of the Nation's Weather Satellite Programs and Policies

Chairman Bridenstine: Good morning and welcome to today's joint Environment and Oversight Subcommittee hearing. I want to thank our witnesses for appearing today.

This Committee has held numerous hearings over the years on NOAA's satellite programs, and today marks the second hearing on this subject so far this Congress. Much has happened since our witnesses last appeared before this Committee, so now is an appropriate time for an update.

First, we received news this fall that the launch of NOAA's GOES-R Satellite, a geosynchronous satellite that will provide crucial weather data over the continental United States, would be delayed from March 2016 to October 2016. While no delay is good news, those who have been following the history of NOAA's satellite programs of record are likely not surprised. GOES, like JPSS, has been delayed numerous times since its inception, adding to the very real possibility of a gap in the critical data that feeds our numerical weather models.

I am also interested in learning more about NOAA's recent update to the life cycle estimates of the current GOES program. To date, this Committee has received minimal supporting documentation from NOAA justifying these changes. I believe a more thorough explanation is necessary because the updated estimate would make it appear on paper that a gap is not a distinct possibility. There is a clear dissonance between NOAA's view and the belief that many hold that the risk of a data gap is high, and I would like to know why.

My concerns about a gap in data were highlighted when we recently learned that a retired NOAA satellite broke up on orbit. While this satellite was not currently in use, it raises questions: how viable are NOAA's satellites as they age? What happens when satellites are extended well beyond their designed life? What components utilized on the satellite that broke up are being used on currently operating NOAA satellites? And what design reviews of satellites being built today are being undertaken?

Due to the critical role satellite observations play in forecasts, it is critical NOAA be vigilant in mitigating, preventing, and avoiding space debris. Losing an operational satellite due to space debris will severely degrade forecasts and put millions of Americans at risk. We need to be certain that our costly satellite systems remain robust and safe.

Finally, I am eager to discuss NOAA's Commercial Space Policy. This Committee has gone to great lengths to better understand the policy, and had some initial concerns regarding the draft document.
For instance, we heard from many in industry that the policy did not include enough detail about how a commercial company will actually partner with the Agency. I know many comments on the policy were submitted, and I look forward to NOAA taking these comments into account and publishing the final

policy as soon as possible. I also look forward to other documents that the Agency has stated are the next step toward incorporating commercial data, including the NESDIS process guide for how commercial companies will begin the process of working with NOAA.

I look forward to discussing these issues and more today. This Committee will remain vigilant in its oversight responsibilities to ensure that Americans have the best possible weather forecasts to save lives and property.

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Chairman BRIDENSTINE. And I'd like to recognize now the Ranking Member, Mr. Beyer, for his opening statement.

Mr. BEYER. Thank you, Mr. Chairman, very much, and thank you, Chairman Bridenstine and Chairman Loudermilk, for holding today's hearing. I'd also like to thank and welcome our witnesses this morning.

As has been stated by our Chairman, the goal of the Committee's oversight in this area is simple. It's to ensure that both the Joint Polar Satellite System (JPSS) and the Geostationary Operational Environmental Satellites (GOES) are technically sound and operationally robust when they're completed, which we all hope is as soon as possible. As satellites that have a critical role in weather forecasting, losing coverage of either system could have serious, perhaps catastrophic effects on our public safety.

Unfortunately, NOAA's development of both of these weather satellite systems has had a rocky path. They've been plagued by cost growth, poor schedule performance, technical issues and management challenges.

During the Subcommittee's hearing on these projects in February it seemed that JPSS was the more troubled of the two but now it looks like GOES–R has now been delayed by more than six months until, as the Chairman said, the new October 2016 launch date, which may still be at risk.

These ongoing delays on these programs increase the cost of the satellites, distort NOAA's budget, and limit the agency's resources for weather forecasting and important research into weather, oceans, and climate science.

We know that satellite acquisition is no easy task and these problems are not unique to NOAA. They routinely occur in the development of satellite programs by the Department of Defense, the U.S. intelligence community, NASA. But that isn't an excuse, and I believe that NOAA recognizes that this is an unsustainable model, and that going forward the agency will need to find a more efficient and more reliable means of putting its instruments into orbit.

Shifting back to the work conducted by Mr. Powner and his team at GAO, it's my understanding that since 2012 they've issued 23 recommendations to NOAA that they believe will strengthen the agency's acquisition efforts and improve their contingency planning, but to date, just six of these recommendations have been implemented. So I'm interested in learning more today about the remaining recommendations and NOAA's progress in addressing them.

Additionally, I think it's important for Congress and this Committee to have a clear understanding of NOAA's policies and planning as it relates to these critical satellites. NOAA's decision to change the expected lifespan of its weather satellites needs to be transparent and clearly documented. NOAA's satellites also provide the data necessary for our weather models and the critical forecasting and warning products and services provided by the National Weather Service. In fact, the capabilities of the National Weather Service are directly dependent on the quality and success of our satellite programs as well as a highly skilled workforce.

So while it's not the focus of today's hearing, I want to mention some important work GAO is conducting on behalf of my colleagues, Ms. Bonamici, Mr. Lipinski, and me. Specifically, we've been concerned about the number of vacancies that currently exist in the National Weather Service's field offices, and we've asked GAO to review present and future staffing levels in order to support the agency's efforts to evolve its operational components and to increase its decision support services. Ensuring an adequate workforce is also central to achieving NOAA's public safety mission. We can't afford a weather satellite gap, and it is essential that NOAA keep these programs on track. I know these are both technically difficult and critically important issues that NOAA needs to address.

So thank you, Mr. Chairman and Mr. Chairman. I look forward to today's hearing.

[The prepared statement of Mr. Beyer follows:]

OPENING STATEMENT
Ranking Member Don Beyer

House Committee on Science, Space, and Technology
Subcommittee on Environment &
Subcommittee on Oversight
"An Overview of the Nation's Weather Satellite Programs and Policies"
December 10, 2015

Thank you, Chairman Bridenstine and Chairman Loudermilk for holding today's hearing. I'd also like to extend a thank you and welcome to our witnesses this morning. As has been stated by my colleagues, the goal of the Committee's oversight in this area is simple. It is to ensure that both the Joint Polar Satellite System (JPSS) and the Geostationary Operational Environmental Satellites (GOES) are technically sound and operationally robust when they are completed, which we all hope is as expeditiously as possible. As satellites that have a critical role in weather forecasting, losing coverage of either system could have serious, perhaps catastrophic effects on public safety.

Unfortunately, NOAA's development of both of these weather satellite systems has had a rocky path—they have been plagued by cost growth, poor schedule performance, technical issues and management challenges.

During the Subcommittees' hearing on these projects in February it seemed that J-P-S-S was the more troubled of the two acquisitions.
However, the launch of GOES-R has now been delayed by more than 6 months and it appears that the new October 2016 launch date is still at risk.

The ongoing delays on these programs increase the cost of these satellites, distort NOAA's budget, and limit the agency's resources for weather forecasting and important research into weather, oceans, and climate science.

Satellite acquisition is no easy task and these problems are not unique to NOAA. They routinely occur in the development of satellite programs by the Department of Defense and the U.S. intelligence community. But that is not an excuse.

I believe that NOAA recognizes that this is an unsustainable model, and that going forward the agency will need to find a more efficient and more reliable means of putting its instruments on orbit.

Shifting back to the work conducted by Mr. Powner and his team at GAO, it is my understanding that since 2012 they have issued 23 recommendations to NOAA that they believe will strengthen

the agency's acquisition efforts and improve their contingency planning. To date, just 6 of these recommendations have been implemented. I'm interested in learning more today about these remaining recommendations and NOAA's progress in addressing them.

Additionally, I think it is important for Congress and this Committee to have a clear understanding of NOAA's policies and planning as it relates to these critical satellite programs. As will likely be discussed in more detail today, NOAA's decision to change the expected lifespan of its weather satellites needs to be transparent and clearly documented.

NOAA's satellites also provide the data necessary for our weather models and the critical forecasting and warning products and services provided by the National Weather Service. In fact, the capabilities of the National Weather Service are directly dependent on the quality and success of our satellite programs as well as a highly-skilled workforce. And while not the focus of today's hearing, I want to mention some important work GAO is conducting on behalf of me, and my colleagues, Ms. Bonamici and Mr. Lipinski. Specifically, we've been concerned about the number of vacancies that currently exist in the National Weather Service's field offices and we've asked GAO to review present and future staffing levels in order to support the agency's efforts to evolve its operational components and to increase its decision support services. Ensuring an adequate workforce is also central to achieving NOAA's public safety mission.

We cannot afford a weather satellite gap and it is essential that NOAA keep these programs on track.

I know these are both technically difficult and critically important issues that NOAA needs to address. Thank you, Mr. Chairman, and I look forward to hearing from both our NOAA and GAO witness today.

Chairman BRIDENSTINE. I thank the Ranking Member for his opening statement.

I'd like to recognize the Chairman of the Oversight Committee, Mr. Loudermilk from Georgia.

Mr. LOUDERMILK. Thank you, Mr. Chairman. Good morning to our witnesses, and thank you for being here. Mr. Chairman, thank you for holding this hearing.

Today we'll be hearing from GAO and NOAA regarding the polar orbiting and geostationary satellite programs. The JPSS and GOES–R programs that NOAA maintains have experienced setbacks. Today we intend to learn what has changed since our last hearing back in February of this year.

Earlier this year, GAO published a report detailing its concern that the NOAA polar satellite program, JPSS, is facing an unprecedented gap in satellite data. GAO believes that while JPSS remains within its new lifecycle cost estimate and schedule baselines, recent rises in component costs and technical issues during development increase the likelihood of a near-term data gap. Additionally, although NOAA has recently reduced its estimated potential gap from fifteen to only three months, GAO noted that this assessment was based on incomplete data and does not account for the risks posed by space debris to satellite hardware. This is even more concerning given the recent breakup of a retired NOAA satellite in orbit. GAO estimated in its report that a data gap may occur earlier and last longer than NOAA anticipates.

Perhaps even more troubling is the potential data gap facing NOAA's GOES–R program, the geostationary satellite system. Since its inception, the GOES–R program has undergone significant increases in cost and reductions in scope, and as GAO's report indicates, NOAA has yet to reverse or even halt this trend, as we have seen with the most recent delay to the launch, pushing a March 2016 launch date back to October 2016. This means we could be facing a long period without a backup satellite in orbit.

History has shown us that backups are sometimes necessary to reduce risk to public safety and the economy. In 2008 and 2012, the agency was forced to use backup satellites to cover problems with operational satellites, a solution we may once again find ourselves needing.

When talking about the consequences of a gap in weather data, the first thought in the minds of many is of the devastating effects of extreme weather on the ground. However, professional and personal history shows me—allows me to discuss the impact of gap weather data on aviation weather.

As a private pilot, I know the importance of having accurate and timely weather forecasts to assess flying conditions. Pilots require accurate weather data to evaluate conditions on the ground and in the sky throughout the entire flight process, from takeoff to landing. Without accurate data a pilot runs the risk of what we call "getting behind the plane," a general aviation phrase which means that the plane is responding to the conditions and the pilot is responding to the plane, a situation that spells trouble for even the most seasoned pilots.

Experience as a pilot does not exempt someone from getting behind the plane as weather deteriorates, as I have conducted many

search-and-rescue missions over the years, even led some of those, and without exception, every missing aircraft that we ended up finding as a result of weather resulted in a fatality. We were basically taking remains home to the families so they can be comforted they were found. Your experience doesn't matter.

Even the most experienced aviators when they get in a weather situation, it can spell disaster, one of those being Scott Crossfield. Scott Crossfield is a pioneer in aviation in America. He was the second to break the sound barrier. We conducted a search-and-rescue mission to find the remains of his plane as it broke up in a thunderstorm over northeast Georgia.

My personal experience as well: once flying to Florida, I had accurate satellite weather data in the cockpit with me which showed thunderstorms coming off the Gulf of Mexico. I was able to accurately determine not only that I should be able to beat the thunderstorm into my destination but also alternate airports to my west that were clear and available. Without that, I could've ended up in a very difficult situation or not made it to my destination. As I was flying in, I also heard of other pilots who didn't have that information with mayday calls being into the weather.

With our reliance on GPS weather data, Mr. Chairman, I'm afraid that without accurate weather, these incidents would be more frequent.

From this perspective, you can see how a gap in weather data, and consequently less accurate forecasts, could negatively affect not only commercial flight safety, but also the $1.5 trillion in total economic activity that the aviation industry contributes to the national economy.

I hope that today's hearing will shed some light on the complex schedule and cost demands facing NOAA's weather satellite programs and that the Subcommittees will walk away better equipped to consider these issues moving forward.

And Mr. Chairman, I know that as an aviator yourself, you understand this as well, and I yield back the balance of my time.

[The prepared statement of Mr. Loudermilk follows:]

COMMITTEE ON
SCIENCE, SPACE, & TECHNOLOGY
Lamar Smith, Chairman

For Immediate Release
December 10, 2015

Media Contact: Zachary Kurz
(202) 225-6371

Statement from Oversight Subcommittee Chairman Barry Loudermilk (R-Ga.)
An Overview of the Nation's Weather Satellite Programs and Policies

Chairman Loudermilk: Good morning, Mr. Chairman, and thank you for holding this hearing today. We are here today to hear from GAO and NOAA regarding the polar orbiting and geostationary satellite programs. The JPSS and GOES-R programs that NOAA maintains have experience setbacks. We intend to hear today what changed since our last hearing in February of this year.

Earlier this year, GAO published a report detailing its concern that the NOAA polar satellite program, JPSS, is facing an unprecedented gap in satellite data. GAO believes that, while JPSS remains within its new life-cycle cost estimate and schedule baselines, recent rises in component costs and technical issues during development increase the likelihood of a near-term data gap. Additionally, although NOAA has recently reduced its estimated potential gap from 15 to only 3 months, GAO noted that this assessment was based on incomplete data, such as the risks posed by space debris to satellite hardware. This is even more concerning given the recent break up of a retired NOAA satellite in orbit. GAO estimated in its report that a data gap may occur earlier and last longer than NOAA anticipates.

Perhaps even more troubling is the potential data gap facing NOAA's GOES-R program, the geostationary satellite system. Since its inception, the GOES-R program has undergone significant increases in cost and reductions in scope, and as GAO's report indicates, NOAA has yet to reverse or even halt this trend, as we have seen with the most recent delay to the launch, pushing a March 2016 launch date back to October 2016. This means we could be facing a long period without a backup satellite in orbit. History has shown us that backups are sometimes necessary to reduce risk to public safety and the economy. In 2008 and 2012, the agency was forced to use backup satellites to cover problems with operational satellites, a solution we may once again find ourselves needing.

When talking about the consequences of a gap in weather data, the first thought in the minds of many is of the devastating effects of extreme weather on the ground. However, professional and personal history lends me the experience to discuss the impact of gap weather data on: aviation weather. As a private pilot, I know the importance of having accurate and timely weather forecasts to assess flying conditions. Pilots require accurate weather data to evaluate conditions on the ground and in the sky throughout the entire flight process, from takeoff to landing. Without accurate data a pilot runs the risk of "getting behind the plane", a general aviation phrase which means that the plane is responding to the weather and the pilot is responding to the plane, a situation that spells trouble for even the most seasoned pilots.

From this perspective, you can see how a gap in weather data, and consequently less-accurate forecasts, could negatively affect not only commercial flight safety, but also the $1.5 trillion in total economic activity that the aviation industry contributes to the national economy.

I hope that today's hearing will shed some light on the complex schedule and cost demands facing NOAA's weather satellite programs and that the Subcommittees will walk away better equipped to consider these issues moving forward.

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Chairman BRIDENSTINE. I'd like to thank the Chairman, Chairman Loudermilk, for his comments. Certainly, I have been in those situations myself, and I appreciate your testimony on them.

Let me introduce our witnesses. First, our first witness today is Dr. Stephen Volz, Assistant Administrator of National Environmental Satellites, Data and Information Services at NOAA. Dr. Volz has a Ph.D. in experimental condensed matter physics from the University of Illinois at Urbana Champaign, a master's degree in physics from The University of Illinois, and a bachelor's degree in physics from the University of Virginia.

Our second witness today is Mr. David Powner, Director of Information Technology Management Issues at the GAO. Mr. Powner received his bachelor's degree in business administration from the University of Denver and attended the senior execute fellows program at Harvard.

In order to allow time for discussion, please limit your testimony to five minutes. Your entire written statement will be made a part of the record, and we on this Committee have mostly probably already read it.

I now recognize Dr. Volz for five minutes to present his testimony.

TESTIMONY OF DR. STEPHEN VOLZ,
ASSISTANT ADMINISTRATOR,
NATIONAL ENVIRONMENTAL SATELLITE,
DATA, AND INFORMATION SERVICES,
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Dr. VOLZ. Well, good morning, Chairmen Bridenstine and Loudermilk, Ranking Member Beyer, and Members of the Subcommittees. Thank you for the invitation to participate in today's hearing and to discuss the status of NOAA's satellite programs.

As both of you or many of you have mentioned, NOAA provides environmental intelligence in a global way that is timely, accurate, actionable and reliable space-based information to citizens, communities and business as they need to stay safe and to operate efficiently.

The NOAA satellite portfolio provides continuous satellite data that are integral to weather forecasting, and NOAA, working with NASA, conducts essential satellite development to ensure the continuity of this critical service.

Our current operational geostationary and polar-operating satellites provide on a 24/7 basis the space-based weather data required to support NOAA's National Weather Service and as well as the private weather industry and many other users who rely on those services as well.

The geostationary satellites currently in orbit, GOES–East and GOES–West, provide constant monitoring from the Atlantic Ocean, the continental United States, Hawaii, and the Pacific for weather, and they are backed up by our fully functioning spare satellite, GOES–14, situated midway between them ready to ride backup, as was mentioned as the need for in the event of a significant satellite anomaly to either of the others.

We are currently working towards an October 2016 launch for the next-generation geostationary satellite, GOES–R. While we are working diligently towards this date, there are still risks ahead of us to get this new highly capable and complex satellite launched on time. NOAA and NASA are working with contractors to identify and mitigate risks by applying all appropriate resources and expertise to meet this important launch milestone. To that end, we are monitoring the health of our current on-orbit assets to ensure that we maximize their operational utility until the GOES–R series satellites are launched, checked out and placed into operations.

Meanwhile, while that's going on with the flight hardware, the ground system for GOES–R and the user community continue to prepare for the launch and rapid exploitation of the new data stream once it begins.

For the polar-orbiting satellites, the first satellite of the JPSS program, the Suomi NPP satellite, is performing exceptionally as NOAA's primary afternoon polar satellite. Four years into its operating mission, the high-resolution sounds of the Suomi NPP, ATMS and CrIS instruments are continuously providing essential observations, feeding the National Weather Service's numerical weather prediction models and ultimately the weather forecasts we all depend on. The Suomi NPP VIIRS imagery has brought much improved observations of sea ice in Alaska and Arctic waters as well as new and much more sensitive VIIRS low-light nighttime cloud imagery for that region as well. Weather observations from polar orbiting satellites are particularly important in Alaska and the polar regions where geostationary satellites cannot effectively observe.

No matter than in March 2017, the second satellite of the JPSS's program, JPSS–1, will be launched joining Suomi NPP in providing global coverage and increasing the data flow supporting the NWS and the user community.

JPPS–2 continues in development managed expertly by NASA and NOAA team and is proceeding on schedule for a late 2021 launch as well.

NOAA's observing system includes beyond these two satellite systems, the Jason-2 and DSCOVR satellites, and soon will include Jason-3, the COSMIC–2 constellation and radio occultation measurements, and hopefully the Cooperative Data and Resure Services mission, CDARS. These smaller and more focused missions provide essential environmental observations augmenting and complementing the polar and geostationary platforms.

In all of these systems, NOAA draws extensively on the expertise of academia and private industry, relies heavily on productive partnerships with other U.S. agencies including specifically the U.S. Air Force and NASA, and on international agencies including EUMETSAT and CNES, and the National Space Organization of Taiwan to meet our observing needs. We also are expanding our approach to access to space through the commercially hosted payload approach for CDARS to find more efficient methods of access to space.

In closing, since joining NOAA just over a year ago, I have continued to work the started by my predecessors to steadily rebuild the robustness of the Nation's operational weather satellite con-

stellations. Our current polar-orbiting and geostationary satellites are aging but are generally healthy as they continue to provide the observations enabling those weather and environmental monitoring missions. We are making steady progress to launch the next generation of polar and geostationary satellites in the coming year to continue and improve the reliability and quality of these Earth observations. NOAA works closely with NASA, our acquisition agent, and with our industry and academic partners to implement proven development processes so that we can meet our critical mission milestones.

Decisions continue to be made by individuals, governments, and businesses based on the weather forecast. Space-based observations are vital, the ability of NWS and commercial weather providers to produce and delivery these forecasts, and NOAA values the long-standing interest of the Committee in our satellite programs, and we appreciate the Congressional support to ensure these critical national weather programs achieve the robust state that is needed to support the Nation's weather enterprise.

Thank you, and I look forward to the conversation.

[The prepared statement of Dr. Volz follows:]

WRITTEN STATEMENT BY
STEPHEN M. VOLZ
ASSISTANT ADMINISTRATOR
NATIONAL ENVIRONMENTAL SATELLITE, DATA,
AND INFORMATION SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

HEARING TITLED
AN OVERVIEW OF THE NATION'S WEATHER SATELLITE PROGRAMS AND POLICIES
BEFORE THE
SUBCOMMITTEE ON ENVIRONMENT AND
SUBCOMMITTEE ON OVERSIGHT
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

December 10, 2015

Chairmen Bridenstine and Loudermilk, Ranking Members Bonamici and Beyer, and Members of the Committee, I am Dr. Stephen Volz, the Assistant Administrator of NOAA's National Environmental Satellite, Data, and Information Service (NESDIS). Thank you for the opportunity to participate in today's hearing on the status of NOAA's satellites.

My testimony today will provide a status update of NOAA's operational satellites that are currently supporting the nation's weather enterprise, along with an update of the acquisition of NOAA's next generation polar-orbiting and geostationary operational satellite systems - Joint Polar Satellite System (JPSS) and Geostationary Operational Environmental Satellite-R (GOES-R) Series Programs, and progress on joint programs with other partners. NOAA maintains productive interagency and international strategic partnerships to develop other programs that provide data to meet validated mission requirements such as satellite altimetry, solar winds monitoring, and radio occultation. NOAA works very closely with NASA, our acquisition agent, and with our industry and academic partners, to implement proven acquisition processes so we can meet our development milestones delivering the essential observations that these satellites provide to the nation. Congressional support has been, and will continue to be, essential to ensure that adequate resources are available to support these programs.

MEETING THE NATION'S SPACE-BASED OPERATIONAL DATA REQUIREMENTS

NOAA's mission to provide science, service, and stewardship to the Nation is fundamentally dependent on comprehensive and accurate observations of our environment. NOAA's satellite observing system provides the observations that are the backbone of its predictive capabilities. NOAA ensures that operational weather, ocean, climate, and space weather information are available 24 hours a day, seven days a week to address our nation's critical civil and military needs for timely and accurate forecasts and warnings of solar storms, extreme weather, and

environmental phenomena, such as hurricanes, tornadoes, thunderstorms, winter storms, floods, wildfires, volcanic ash, fog, and sea ice.

NOAA's NESDIS has managed the operation of polar-orbiting operational environmental satellites since 1966 and geostationary operational environmental satellites since 1974. Over the decades, these systems have supported weather and environmental monitoring programs that are relied upon by users in the United States (U.S.) and around the world. Satellites, anchored and validated by *in situ* ground and airborne observations, provide more than 95 percent of the data routinely assimilated into NOAA's National Weather Service (NWS) numerical weather prediction (NWP) models. These NWP models are used to forecast the weather seven or more days ahead, and, in particular, output from the NWP models are essential to forecasting the development of extreme weather events, including hurricanes and blizzards. Of those satellite observations, more than 80 percent are from polar-orbiting satellites, including the NOAA/NASA Suomi National Polar-orbiting Partnership (Suomi NPP) satellite, which is the primary satellite for weather observations in the afternoon orbit. NOAA's NWP models also rely on data from the European Metop satellites that fly the other primary polar satellite in the mid-morning orbit. Older secondary satellites, such as NOAA's Polar-orbiting Operational Environmental Satellite (POES) and NASA's Earth Observing Satellites (EOS), supplement Suomi NPP.

The American public relies on accurate, reliable, and timely weather information from NOAA's NWS to protect themselves, their families, and their property. The private weather sector, which delivers specialized weather information to its users, also relies on full, free, open, and timely access to NOAA's observations, products, and information, and data provided by NOAA's international partners. NOAA's satellites are an integral part of the nation's observational infrastructure that supports these NWS and private sector forecasting capabilities.

STATUS OF NOAA's SATELLITE SYSTEMS

I. Geostationary Operational Environmental Satellites (GOES)

NOAA's satellites are our observational sentinels in space, providing constant watch for severe weather such as hurricanes, thunderstorms, flash floods, and wildland fires in the Western Hemisphere. The GOES satellites are part of a larger, global partnership, and NOAA maintains agreements with the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) and the Japanese Meteorological Agency, ensuring the full, free, open, and timely sharing of all observational data and through which each agency provides additional backup to the others in the event of the loss of a satellite.

NOAA's two operational GOES satellites, operating over the Pacific Ocean and off the east coast of the United States over the Atlantic Ocean (known as GOES-West and GOES-East, respectively) provide consistent, reliable service and are currently supporting the nation's weather needs. GOES-East and GOES-West are operating nominally and are providing data every 15 minutes to weather forecasters to support their forecasts and warnings. Although GOES-West experienced a component anomaly (i.e., loss of one of the two remaining star trackers) in April 2015, the satellite continues to operate on the single remaining star tracker,

continuing to meet all user performance requirements while the engineering team works with the component manufacturer to attempt to recover the affected subsystem. In November, the GOES-East sounder filter wheel failed, however, the imager continues to support NWS weather forecasting needs. An on-orbit spare (GOES-14) is available as a backup in the event either of the operational satellites fails to meet performance requirements. The GOES satellites complement *in situ* observational systems, such as NOAA's Doppler Radar network, NOAA's Hurricane Hunters, surface observation platforms and ocean buoys, to provide NWS forecasters with near real-time data used to support operational weather forecasts.

NOAA is working with NASA as its acquisition partner and with the support of the private sector to complete the development of the GOES-R series satellites, NOAA's next-generation geostationary environmental satellite constellation. The advanced GOES-R Series Program content remains unchanged since the Congressional Baseline report was submitted in February 2013. The GOES-R Series Program consists of four spacecraft (GOES-R, -S, -T, and -U) and associated instruments, ground system and its antennas, mission management, product generation and distribution, and enterprise management. This constellation will provide data continuity through 2036. The GOES-R series will provide GOES continuity as well as needed and widely-anticipated enhancements of required weather and space weather data, such as three times more channels, four times better resolution, and five times faster scans than the current GOES-East and GOES-West satellites. The enhanced GOES-R series capabilities are the result of the instrument suite that includes:

- Advanced Baseline Imager (ABI)
- Geostationary Lightning Mapper (GLM)
- Space Environmental In Situ Suite (SEISS)
- Extreme Ultra Violet / X-Ray Irradiance Sensor (EXIS)
- Solar Ultra Violet Imager (SUVI), and
- Magnetometer

II. Update on the GOES-R Series development

In 2015 the GOES-R Series Program team, co-led by NOAA and NASA and working with the spacecraft manufacturer, Lockheed Martin, completed the assembly and integration of the first satellite in the new series, GOES-R. After a thorough review of the remaining work needed prior to launch, NOAA, with input from the combined GOES-R team, moved the GOES-R launch planning date from March 2016 to October 2016. NOAA, NASA, and Lockheed Martin will continue close coordination as the final year of activities are completed leading up to the GOES-R launch. The GOES-R team is applying all lessons learned from the last two years of GOES-R satellite development to ensure a timely and successful completion of the GOES-S, -T-, and -U satellites.

Status of the GOES-R satellite

In late August, the GOES-R satellite completed thermal vacuum testing at Lockheed Martin's facility in Littleton, Colorado. Successful completion of this test, which simulates the extreme hot and cold temperatures it will experience in space as it orbits the Earth, is an important

milestone for the satellite. The satellite is now being prepared for vibration testing, which will simulate the experience of launching into space aboard the Atlas V launch vehicle.

The GOES-R Series Program successfully completed its Flight Operations Review at the NOAA Satellite Operations Facility in Suitland, Maryland, on November 6, 2015 with all criteria rated "green" by the independent review team, indicating that the Program is able to execute all phases and modes of mission operations, data processing, and analysis.

Reasons for the Change of the GOES-R Launch Readiness Date

Once satellite integration and testing began in late 2014, the spacecraft vendor experienced challenges that resulted in schedule erosion. The challenges were due to complications that were related to the complexity of the GOES-R spacecraft. To meet the GOES-R mission requirements, the spacecraft must support stringent instrument interface needs, including separate Earth and sun pointing platforms, and complex command and data handling capabilities. This schedule erosion occurred at a rate that challenged achievement of the March 2016 launch date. In early 2015, GOES-R experienced a failure of the Solar Array Drive Assembly (SADA). The SADA is part of the mechanism that holds the solar array on to the spacecraft bus, and rotates to allow the wing to always face the sun. The additional time required to remove, fix, reinstall, and test the SADA made achievement of the March 2016 launch date very unlikely.

NOAA has known for some time that the integration and test schedule was aggressive, yet believed that the March 2016 launch date was achievable and the GOES-R team continued to address the integration challenges. In the May – July 2015 timeframe, it became clear to NOAA, NASA, and Lockheed Martin that Lockheed Martin would not be able to maintain the pace needed to meet a March 2016 launch date based on integration and test (I&T) execution inefficiencies, including complications associated with the complexity of the spacecraft and the SADA failure.

As a result, NOAA, in its role as the overall GOES-R Series program manager, consulted with NASA and Lockheed Martin to initiate the steps to establish a new supportable launch readiness date. The next possible launch date was in October 2016 and we determined that the GOES-R satellite would be ready with reasonable schedule reserve for that date. With a new launch date of October 2016, the government and its contractors can focus on completing the GOES-R satellite and meet the expectations of our users and stakeholders. I want to stress that there are still risks in front of us to get this newly designed, highly capable and complex satellite launched on time. An example of this includes concerns with failed transistor parts in the Scalable Power Regulator Units (SPRUs) that would affect the satellite's ability to charge and discharge its batteries. Troubleshooting of the failed transistors revealed high moisture and nickel dendritic growth inside the transistor. Consequently, we have directed Lockheed Martin to remove all transistors from the affected lot and install replacements. We anticipate these repairs will take a couple months to complete but do not expect it to affect GOES-R's launch schedule at this time.

Status of the GOES-S Satellite

The GOES-R Series Program continues to make steady progress with the GOES-S spacecraft and the six flight instruments. All GOES-S instruments have been delivered for integration to the GOES-S spacecraft. The ABI, EXIS, and SEISS instruments were delivered in September 2015, and the GLM was delivered in November 2015. The SUVI and EXIS instruments have been successfully installed on the GOES-S solar pointing platform. The GOES-S System Module integration and testing continues. Additionally, the GOES-S propulsion module was delivered in October 2015 to the Lockheed Martin Denver facility in preparation for integration with the GOES-S system module. With the GOES-R launch delay, NOAA expects a downstream impact on the development schedule for the GOES-S satellite. The GOES-R Series Program is currently assessing the extent to which the GOES-S satellite will be delayed.

Status of the GOES-R Series Ground System

Excellent progress continues to be made on the ground system. The satellite command and control system and the data processing and distribution capability have been delivered, initial checkout and testing has been completed and they are now in the hands of the operations team. All NOAA Satellite Operations Facility antennas have completed their certification, are being used for current operations, and are ready for GOES-R operations. Two 16-meter antennas at NOAA's Wallops, Virginia Command, Data, and Acquisition Station are complete and available for current operations. The GOES-R Series Program also completed its third successful Data Operations Exercise which delivered 14 days of simulated data to the NWS.

II. Polar-orbiting Operational Environmental Satellites

NOAA's polar-orbiting operational environmental satellites provide full global coverage for a broad range of weather and environmental applications. Placed in the afternoon orbit, these satellites provide observations to support NOAA's three to seven-day operational weather forecasts, operational weather "nowcasting" in Alaska and polar regions, and environmental monitoring and prediction.

Partnership with EUMETSAT

Through NOAA's partnership with EUMETSAT, their Metop satellite constellation (Metop A and Metop B), which fly in the mid-morning orbit, has provided a significant amount of the critical observations that NOAA assimilates into its operational NWP models. NOAA is working with EUMETSAT to integrate the three NOAA instruments[1] that will be hosted on the Metop C satellite when it launches in 2018. EUMETSAT hosted the same three NOAA-provided instruments which currently fly on the Metop A and Metop B. By leveraging these data from EUMETSAT, NOAA avoids the cost of building and launching its own satellite system in the mid-morning orbit. NOAA is also working with EUMETSAT as they develop their Metop-Second Generation constellation which will be launched and operational in the early 2020s. NOAA and EUMETSAT plan to establish a new agreement in December 2015 which will continue this very successful polar-orbiting partnership over the next two decades with mutual full, open, free, and timely data sharing.

[1] Space Environment Monitor (SEM); Advanced Very High Resolution Radiometer (AVHRR); Advanced Microwave Sounding Units (AMSU).

II.1 Status of Suomi NPP

The Suomi NPP satellite is NOAA's primary afternoon polar-orbiting satellite; it was launched in October 2011 with a five-year design life. Its Advanced Technology Microwave Sounder and Cross-track Infrared Sounder instruments provide operational data to NOAA's operational NWP models. The Visible Infrared Imaging Radiometer Suite instrument provides operational now-casting observations in Alaska and polar regions, in addition to other environmental observations. Other NOAA, NASA, and Department of Defense legacy system satellites are currently providing additional observations from the afternoon orbit and other orbit crossing times.

Suomi NPP continues to function well, completing its fourth year on orbit on October 28, 2015. The second annual Operations Status Review, followed by the NOAA/NASA Suomi NPP Joint Steering Group, confirmed that the mission is meeting or exceeding expectations in quality of the data products. Recently the JPSS Program completed a first edition of the Suomi NPP Longevity Plan, and NOAA has implemented steps as recommended in that plan to maintain the long-term health of Suomi NPP. NOAA's annual lifetime analysis report indicates a high probability (greater than 80 percent) that the expected lifetime of Suomi NPP will extend beyond JPSS-1 launch and commissioning. The pace of user adoption of Suomi NPP data has substantially exceeded past missions flying new design instruments for the first time.

Partnership with Japan Aerospace Exploration Agency (JAXA)

The NOAA partnership with JAXA continues to provide important returns to our forecasting products. The JAXA Global Change Observation Mission 1-Water (GCOM-W) supplies data to meet key JPSS Program water cycle observation requirements. NOAA forecasters are using data from the GCOM-W polar-orbiting satellite which flies the Advanced Microwave Scanning Radiometer 2 (AMSR2) instrument. AMSR2 data improve forecasters' ability to monitor the development, location, and structure of tropical cyclones, specifically, high-resolution imagery and rainfall measurements that aid hurricane specialists and weather forecasters in tracking the precipitation intensity, location, and structure of tropical cyclones, (also known as hurricanes). Ice concentration information from AMSR2 and ice coverage information from the Multisensor Analyzed Sea Ice Extent product are blended together to substantially improve ice forecast skill. By leveraging these data from JAXA, NOAA avoids the cost of building and launching its own satellite system in order to produce AMSR2 data.

II.2 Status of JPSS-1 development

NOAA is working with NASA as its acquisition partner and with the support of the private sector to continue building NOAA's next-generation polar-orbiting operational environmental satellite constellation, the JPSS Program. The JPSS Program consists of three satellites, Suomi NPP, JPSS-1 and JPSS-2; associated instruments, the ground system, mission management and operations, product generation and distribution, and management. The JPSS Program is focused to support the weather mission and the following instruments:

- Advanced Technology Microwave Sounder (ATMS)
- Cross-track Infrared Sounder (CrIS)
- Visible Infrared Imaging Radiometer Suite (VIIRS)
- Ozone Mapping and Profile Suite (OMPS)-Nadir[2]
- Clouds and the Earth's Radiant Energy System (CERES), only on Suomi NPP and JPSS-1 and accommodations for a NASA-provided Radiation Budget Instrument (RBI) on JPSS-2

The launch commitment date for the JPSS-1 satellite of no later than the second quarter of FY 2017 remains unchanged since the Congressional Baseline Report was submitted in November 2014. JPSS-1 satellite integration and test work is on track. The JPSS Program encountered an issue with ATMS that delayed its delivery to the spacecraft by more than a year, until December 2015. However, the team managed the overall systems integration to maintain the JPSS-1 launch date. The issue stemmed from a set of parts built under the predecessor program. The ATMS had to be disassembled and the problem parts repaired; then the instrument required re-assembly and retest. That retest is going well, and ATMS is forecast to be delivered prior to the need date at the end of December 2015.

Status of the JPSS ground segment

Suomi NPP was launched in 2011 as a NOAA-NASA risk reduction mission, which we decided to use operationally as a gap mitigation measure between the end of the NOAA-19 useful life and when JPSS-1 would begin to provide data for operational use. The ground system met the performance requirements for this risk reduction mission but was not designed with the necessary features required to meet NOAA's operational mission requirements for IT security and 24x7 robustness. The JPSS Ground System upgrade, Block 2, will meet all NOAA's operational requirements. The version of the JPSS ground segment currently deployed continues to support operations. The Block 2 upgrade provides multi-mission capability, supportable modern hardware and software, IT security features, and robustness. All the hardware and software have been deployed at all operating sites and all the major integration activities have been conducted. Parts of the new system have transitioned to operations with the currently deployed system.

The new system recently progressed into its second integrated test exercising all functions, and supported the first joint test with the JPSS-1 satellite. From the tests, we have identified issues to be addressed and added additional expertise to the ground development team. An independent review of the ground system is scheduled to occur shortly. The Ground System Block 2 will continue the support to Suomi NPP in FY 2016 and provide the additional support needed for the JPSS-1 launch in early FY 2017.

The schedule of remaining ground system test and verification events and activities will continue to be coordinated with the JPSS-1 flight schedule to minimize conflicts and ensure readiness for the JPSS-1 launch.

[2] The OMPS-Nadir and -Limb sensors are currently flying on Suomi NPP. NOAA will fund OMPS-Nadir for JPSS-1, JPSS-2, PFO/JPSS-3 and PFO/JPSS-4. NASA will fund and provide OMPS-Limb for JPSS-2.

II.3 Status of JPSS-2 development

The JPSS-2 development is well underway. All four instruments are in the parts procurement, sub-assembly integration, and test phase. Some significant risks have been successfully addressed as these instruments progress. The spacecraft work for JPSS-2 was initiated in July 2015, and the first review milestone for it was successfully conducted this fall. The JPSS Program is working towards the accelerated JPSS-2 launch commitment date of the first quarter of FY 2022.

In summary, Suomi NPP is performing very well, and despite some challenges in both flight and ground, we are within budget and on schedule for JPSS-1 and JPSS-2.

II.4 Polar Follow-on (PFO)

The FY 2016 budget requested $380 million for PFO to initiate a robust polar observing system in the afternoon orbit through approximately 2038. PFO is a necessary continuation of the JPSS Program, poised to be implemented with the receipt of FY 2016 appropriations.

This planning is aimed at achieving a robust and fault-tolerant position as recommended by the Government Accountability Office (GAO), the Office of Inspector General, external reviews by the Tom Young-chaired Independent Review Team (IRT), and Congressional direction. The PFO plan achieves a resilient and fault-tolerant position by 2023 and secures that position through approximately 2038. To implement the plan, the President's FY 2016 budget requested funds to acquire two additional satellites as copies of the JPSS-2 model - PFO/JPSS-3 and PFO/JPSS-4. This request represents the minimum funding required to achieve robustness at the earliest possible date. This funding provides continuation of all instrument contracts for PFO/JPSS-3 and PFO/JPSS-4 and ensures best value by continuing a two instrument block buy based on the design and manufacturing processes proven with the JPSS-2 instrument procurements. The PFO plan retires significant instrument development hardware and schedule risks through smooth continuation of the JPSS-2 contracts. It also enables the soonest delivery of the PFO/JPSS-3 and PFO/JPSS-4 missions to a launch ready state to secure a robust polar constellation as early as possible (in 2023). The availability of PFO/JPSS-3 hardware will provide NOAA the option to launch a contingency sounder-only mission in the event JPSS-1 fails earlier than expected or the JPSS-2 satellite experiences a launch mishap. To ensure that the planning activities remain on track, NOAA has successfully utilized prior support from Congress to prepare the necessary contractual actions needed for rapid progress starting early in FY 2016.

In addition, PFO tests the cutting-edge microwave sensor, EON-MW, to be hosted on a proven cubesat platform. This approach develops and demonstrates potentially revolutionary technologies which could lower cost and enable the development of more robust future systems. The launch of EON-MW in FY 2019 will provide near-term gap mitigation benefits for NOAA's current systems.

III. Solar Wind Measurement from Lagrange-1

NOAA has an operational requirement for continuous measurement of solar wind data from Lagrange-1 point, which is approximately 1 million miles toward the Sun from Earth. Solar wind is the constant stream of charged particles and magnetic fields emitted from the sun. Like terrestrial weather in Earth's atmosphere, space weather refers to conditions like solar wind in the solar system and particularly in near-Earth space. Space weather events can cause geomagnetic storms, and solar wind data are the sole input for short-term warnings (15 - 45 minutes) of such geomagnetic storms. Geomagnetic storms have the potential to cause significant economic impact to telecommunications and electrical grid infrastructure that are particularly sensitive to these space weather phenomena.

III.1 Status of the Deep Space Climate Observatory (DSCOVR)

The DSCOVR satellite was successfully launched in February 2015 to meet solar wind operational requirements of the NWS Space Weather Prediction Center (SWPC) and the Air Force Space Weather Agency. These solar wind requirements have been met until now by using data from NASA's research satellite, the Advanced Composition Explorer (ACE). However, the ACE mission was launched in 1997 and has been operating beyond its design life. DSCOVR has a five-year planned mission and provides continuity of these data at the Lagrange-1 point. DSCOVR reached its intended orbit on schedule this June and has been undergoing post-launch calibration and validation activities. The DSCOVR satellite was successfully handed from NASA to NOAA for operational command and control on October 28, 2015. After extended commissioning and calibration, the NWS SWPC will transition to using DSCOVR data operationally, expected in Spring 2016.

Currently, NOAA's space-based solar wind detection system is operating as a single-string constellation. The President's FY 2016 Budget request initiates a number of steps to build in robustness to this important data requirement through two separate funding requests. The first is to provide funds to operate DSCOVR, and the second is to provide funds to begin to analyze options from the Analysis of Alternatives for critical space weather observations and to initiate development of the Space Weather Follow-on mission. A typical development cycle for a program of this type is 48 months from contract award to launch; therefore it is imperative that NESDIS begin this work in FY 2016 in order to begin the detailed program work in FY 2017. This schedule enables the Space Weather Follow-on mission to be in place soon after the DSCOVR satellite reaches its five-year mission life in 2020.

IV. Satellite Altimetry – Jason series

Starting with Topex/Poseidon and continuing with Jason-1 and Jason-2, NOAA has used satellite altimetry data to provide precise measurement of sea surface height for several applications, including but not limited to, ocean modeling, forecasting El Niño/La Niña events, and hurricane intensity prediction. The Jason series program is a joint program among NOAA, NASA, EUMETSAT, and CNES (the French Space Agency), with costs shared among all partners and data shared globally on a full, free, open, and timely basis.

The current satellite on orbit is Jason-2. Jason-2 was launched in 2008 and is operating two years beyond its design life of five years, and it continues to provide data to support civil and military

user requirements. The follow on, Jason-3, has been developed and was scheduled for launch in August 2015 on a SpaceX Falcon 9 launch vehicle. However, the loss of the SpaceX International Space Station resupply mission on June 28, 2015 has delayed the launch until the successful resolution of the SpaceX-related launch issues. We anticipate SpaceX will conclude their Accident Investigation Team activity with the FAA soon, and that the NASA Launch Services Program (LSP) will shortly thereafter also conclude their Independent Review Team (IRT). The results of the NASA LSP-led IRT will inform whether NASA believes that the SpaceX launch vehicle is ready to successfully launch the Jason-3 satellite. The goal is to launch Jason-3 in time to provide for on-orbit calibration with Jason-2.

The President's FY 2016 Budget request for Jason-3 proposes to transition the acquisition, development, and deployment of future space-based ocean altimetry observations to NASA, who will work in partnership with EUMETSAT and other European partners. NOAA and NASA and its European partners are discussing the appropriate data sharing agreements that will provide for continued support of NOAA's operational data requirements.

V. Radio Occultation – COSMIC Series

The Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) activity is a six-satellite constellation launched in 2006 as a joint collaboration research effort with costs and responsibilities shared among Taiwan, National Science Foundation, NASA, the U.S. Air Force (USAF), and University Corporation for Atmospheric Research (UCAR). Using data from the COSMIC mission, NOAA validated that atmospheric soundings provided through this radio occultation (RO) approach improved the quality of NWP forecasts. NOAA began using these experimental system observations operationally in NWS NWP models shortly after the observations were available in 2006. These RO data have been made available globally on a full, free, open, and timely basis. NOAA's Commercial Policy outlines how NOAA would evaluate commercially available RO data that could supplement data from the COSMIC series to support NOAA's weather and environmental observation requirements.

V.1 Status of the COSMIC-1 Series

The satellites in the COSMIC-1 series reached the end of their design lives in April 2011; currently one satellite has failed and two satellites are in degraded operation, leaving five of the original six satellites that are still providing data or in a degraded capacity.

V.2 Status of COSMIC-2 Development

The COSMIC-2 constellation is a continuation of the COSMIC-1 mission with advanced technology that will significantly increase the geographic coverage and quantity of observations. Under a partnership agreement between the United States (NOAA and USAF) and Taiwan, the COSMIC-2 mission will develop and deploy an operational constellation of 12 Global Navigation Satellite System (GNSS) Radio Occultation (RO) satellites; the first six will be launched into an equatorial orbit, and the second six into a polar orbit. The COSMIC-2 constellation is expected to provide ten times the number of daily soundings that COSMIC-1 currently provides, which would increase the benefits to weather forecasting. Activities to

support launch of the first set of satellites in equatorial orbit, COSMIC-2A, are on track for a planned launch in in late FY 2016 / early FY 2017.

COSMIC-2B, the polar-orbiting second set of six satellites, is at the beginning stages of development with the goal of a planned late FY 2018 / early FY 2019 launch date. Taiwan has received permission to acquire the COSMIC-2B spacecraft buses, and NOAA has requested funds in the President's FY 2016 Budget request to begin development of the COSMIC-2B instruments. NOAA is working with NASA's Joint Agency Satellite Division in the Science Mission Directorate to provide the acquisition of the COSMIC-2B instruments.

VI. Solar Irradiance, Data, and Rescue (SIDAR)

SIDAR is an international partnership among the United States, CNES, and the Department of National Defence – Canada (DND). CNES and DND are jointly providing the equivalent of approximately USD $100 million of support in the form of SARSAT and Argos ADCS instruments for the SIDAR program. NOAA funded development of the Total and Spectral Solar Irradiance Sensor (TSIS). The President's FY 2016 Budget proposed transfer of TSIS to NASA for launch to the International Space Station by 2017. This transfer was completed at the beginning of FY 2016. NASA's Earth Science Division within the Science Mission Directorate is responsible for seeking TSIS flight opportunities.

When NOAA-19 was launched in February 2009, it carried two communications instrument suites: the Search and Rescue Satellite-aided Tracking (SARSAT) and Argos Data Collection System (Argos DCS).

Cospas-Sarsat is an international, humanitarian search and rescue system that uses satellites to detect and locate emergency beacons carried by ships, aircraft, or individuals. The system consists of a network of satellites, ground stations, mission control centers, and rescue coordination centers. Search and rescue instruments are flown on polar-orbiting satellites. These instruments detect signals transmitted from emergency beacons on the Earth's surface. The search and rescue instruments are built by the DND and by CNES and provided to NOAA for flight and on-orbit operations. Since SARSAT went operational in 1982, more than 37,000 people have been rescued worldwide, including 7,700 people in the U.S.; 240 people were rescued in the U.S. in 2014. The United States Code of Federal Regulations requires that general aviation[3] and maritime[4] vessels carry these emergency location beacons on-board.

The Argos Data Collection and location System (DCS) is a data collection and relay program that provides global coverage and platform location. The Argos system aboard polar-orbiting satellites provides worldwide coverage. Additionally, incorporating the Argos instrument on a moving satellite allows for locating an *in situ* platform using Doppler shift calculations. This positioning capability permits a wide variety of applications such as monitoring drifting ocean buoys and studying wildlife migration paths. A global operational system since 1970, Argos DCS has nearly 2,000 users who currently track more than 20,000 active platforms placed on

[3] 14 CFR 91.207 - Emergency locator transmitters
[4] 46 CFR Part 25, Subpart 25.26 - Emergency Position Indicating Radio Beacons (EPIRB)

wildlife, meteorological and oceanographic buoys, fishing vessels, and other sensitive commodities. Notably, U.S. applications account for approximately 40 percent of total system use, on average; there are 44 distinct projects being managed by various NOAA offices.

Both constellations require replenishment to ensure continuity of these critical services. The President's FY 2016 Budget request for SIDAR is NOAA's plan to accommodate SARSAT and enhanced Argos Advanced DCS (Argos ADCS) instruments for launch in 2019. The FY 2016 Budget request transfers the built Total and Spectral Solar Irradiance Sensor (TSIS) to NASA for launch onto the International Space Station in 2017.

NESDIS is finalizing an interagency agreement with the U.S. Air Force to use its Hosted Payload Solution (HoPS) contract for commercial hosting of the Argos Advanced-Data Collection System (A-DCS) and SARSAT instruments. NOAA funding requested in FY 2016 enables NOAA to continue work with the HoPS program.

CONCLUSION

The nation's weather satellite programs are proceeding well through the final integrated systems test phase leading to the planned launch of GOES-R in October 2016, and JPSS-1 no later than March 2017. This progress is only possible with the close coordination between NOAA and NASA, and its partners, and with the continued support of the Administration and the Congress. We are confident in the combined expertise of our NOAA, NASA, and aerospace partner teams, and the proven acquisition processes that have supported the successes of the GOES-R Series and JPSS Programs. NOAA has been working steadily to rebuild the robustness of the geostationary and polar-orbiting satellite constellations, while taking maximum advantage of existing NOAA and international and interagency partner orbital assets to provide robustness and redundancy today. NOAA is also progressing well in the development of other satellite systems in partnership with other U.S. and international agencies. The Jason-3 satellite has completed development and is awaiting resolution of SpaceX launch issues before it can be launched. The COSMIC-2A satellites are on schedule for launch in late FY 2016 / early FY 2017. NOAA is preparing to pursue commercial hosted payload opportunities to provide continuity of the SARSAT and Argos-Data Collection System using Air Force contracting processes.

Finally, NOAA values the long-standing interest by the Committee in NOAA's satellite programs. We understand the difficult fiscal environment that we find ourselves in and appreciate the Congressional support to ensure that these critical national programs are supported to the maximum extent possible.

Stephen Volz

Assistant Administrator for Satellite & Information Services
National Oceanic and Atmospheric Administration (NOAA)

Dr. Stephen Volz is the NOAA Assistant Administrator for Satellite and Information Services. NOAA's Satellite and Information Service is dedicated to providing timely access to global environmental data from satellites and other sources to promote, protect and enhance the Nation's economy, security, environment and quality of life. In this role Dr. Volz leads the acquisition and operation of the nation's civil operational environmental satellite system. He also leads efforts for research and development of products and programs to archive and provide access to a variety of Earth observations via three national data centers.

Dr. Volz is a leader in the international Earth observation community, serving as the NOAA Principal to the Committee on Earth Observation Satellites (CEOS). In this capacity he leads efforts to coordinate global satellite-based observations among international space agency partners to further the development of a Global Earth Observation System of Systems. In addition, Dr. Volz serves as the Co-Chair of the NOAA Observing Systems Council, a group that coordinates observing systems requirements and provides resource recommendations for NOAA's observation platforms. He is also a member of the NOAA Executive Council, NOAA's executive decision-making body.

Dr. Volz previously served as the Associate Director for Flight Programs in the Earth Science Division of NASA's Science Mission Directorate. As the Program Director, Dr. Volz managed all of NASA's Earth Science flight missions and associated activities. Within this flight portfolio, Dr. Volz managed a line of Principle Investigator (PI) led missions in airborne science, small satellites, and instrument missions of opportunity, including the development of the Announcements of Opportunity to solicit the science and mission proposals, along with their subsequent evaluation and selection. Steve managed within the flight program a suite of Distributed Active Archive Centers (DAACs) that process, distribute, and archive all of NASA's Earth science data, as well as the science research data products developed from these and other satellite remote-sensing data. Dr. Volz worked with domestic and international space agencies to actively support and promote partnerships and collaboration to further NASA and the nation's Earth science remote-sensing objectives, and to maximize the beneficial utilization of NASA's Earth science data.

Dr. Volz has 26 years professional experience in aerospace. Prior to serving as the Flight Program Director, Dr. Volz was the Earth Science program executive for a series of Earth Science missions, including EO-3 GIFTS, CloudSat, CALIPSO, and ICESat, and he led the Senior Review for the Earth Science operating missions. Dr. Volz worked in industry at Ball Aerospace and Technologies Corporation from 1997–2002, where he was the Project Manager for the Space Infrared Telescope Facility superfluid helium cryostat and other flight projects. From 1986–1997 Dr. Volz worked for NASA's Goddard Space Flight Center as an instrument manager, an I&T Manager, a systems engineer, and a cryogenic systems engineer on missions and instruments including the Cosmic Background Explorer (COBE), among others.

Dr. Volz is a member of several professional societies, including the American Physical Society (M'82), the American Astronomical Society (M'87), the American Geophysical Union (M'02), and the American Meteorological

Society (M'08). He is a senior member of the Institute of Electrical and Electronics Engineers (IEEE), an active member of and participant in the Geoscience and Remote Sensing Society (GRSS), and a member of the GRSS Administration Committee (AdCom) for the period of 2013–2017. He is the recipient of several awards, including the Silver Snoopy Award from NASA's astronaut team in 1994 for his work as the instrument manager and team lead for the Space Shuttle cross bay mounted Superfluid Helium On Orbit Transfer (SHOOT) experiment, the Goddard Space Flight Center John Boeckel Award for Engineering Excellence (1992), and the Ball Corporation Award of Excellence from the Ball Aerospace and Technology Corporation (BATC) in 2001.

Dr. Volz has a doctorate in Experimental Condensed Matter Physics from the University of Illinois at Urbana-Champaign (1986), a master's in Physics from Illinois (1981), and a bachelor's in Physics from the University of Virginia (1980). He has more than 20 publications in peer-reviewed journals.

Dr. Volz is a native-born Washingtonian, and lives in Bethesda with his wife Beth and his two teenage daughters.

Chairman BRIDENSTINE. Thank you for your testimony, Dr. Volz. You were right on the five minute mark, which is what we expect from our NOAA and former NASA folks, so thank you for that.

Mr. Powner, you are recognized for five minutes.

TESTIMONY OF MR. DAVID POWNER,
DIRECTOR, INFORMATION TECHNOLOGY MANAGEMENT ISSUES,
GOVERNMENT ACCOUNTABILITY OFFICE

Mr. POWNER. Chairman Bridenstine, Loudermilk, Ranking Member Beyer, and Members of the Subcommittees, earlier this year, we testified on the GOES–R and JPSS satellite acquisitions. At that time we expressed concerns about the GOES–R March 2016 launch date and potential gaps in satellite coverage.

As we have heard, the GOES–R launch date has been delayed again. I will provide updates on both acquisitions by displaying three graphics, which highlight key launch dates and expected lifespans of these satellites, many of which have been recently extended.

On the first graphic, it displays the three GOES–R satellites that are currently in space. The first bar is GOES–13, which covers the eastern half of the United States. The third bar is GOES–15, which covers the western half. The middle bar is GOES–14, which is your on-orbit spare. NOAA's policy is to have an on-orbit spare if something goes wrong with one of the operational satellites.

The red bars here represent an extension to the lifespan of the operational satellites from the last time we testified. When asked what this was based on, we were given a 2005 document supporting the lifespan extension. So a key question is why NOAA did not disclose this lifespan extension sooner.

I'll add that in NOAA's 2016 budget submission, these red extensions were not included on their fly-out charts. This is an area where NOAA needs to be more open and transparent with the Congress, especially since longer lifespans affect the timing of future launches and the annual funding of these satellites, as I'll get into on the next chart.

But before we leave this chart, I'd like to comment on, there have been problems with GOES–13 that have been mentioned, and the backup has been moved into operation several times. Also, currently a key sensor on GOES–13 has not been working since November 20th.

Moving to the next chart, what this next chart does, the first three bars basically just replicate what you just saw with the extended lifespan. The fourth bar represents GOES–R and the delay in the launch of GOES–R to October 2016. I have three comments on this chart.

First, the GOES–R bar, the fourth bar down, the delay occurred due to technical problems in about two years of extremely poor schedule performance. The program was losing about 10 days per month for a 24-month period. Mr. Chairman, in our opinion, NOAA should have more clearly disclosed the poor schedule performance to this Committee.

My second point is the potential gap in backup coverage. The gold vertical bar here represents this projected gap. GOES–13,

even with the lifespan extension, reaches the end of its useful life about mid-2016, and 2014 and 2015 are your operational satellites. So there is no backup in orbit from mid-2016 until GOES–R launches and performs a six month checkout through about March or April of 2017. And if the GOES–R October 2016 launch date is not met, this gap in backup coverage becomes even greater.

My third and final point on this chart is the final two bears, GOES–S and T. We agree that both GOES–R and JPSS need to have robust constellations to ensure continuity of coverage, and this is exactly why we placed the potential gaps in weather satellites on GAO's high-risk list in January 2013. But extending these lifespans requires a relook at the timing of out-year satellites.

With the third chart, I'd like to move the discussion from GOES–R to JPSS, the polar satellites. As you can see here, the red arrow represents a four-year lifespan extension on NPP, the current operational polar satellite in the afternoon orbit. We question whether this should extent to 2020, given NOAA's latest analysis supporting this. However, the good news here with JPSS is there is an annual review that is used to update the polar satellite lifespans, unlike the GOES programs.

Regarding the J–1 launch, the middle bar here, of March 2017, we are more concerned about this date than we have been prior. Key reasons are continued delays in delivery of the key instrument ATMS, continued delays in the ground system, and continued problems with a component on the spacecraft.

And finally, on the chart, we think there is increased risk with J–2 since we have a new spacecraft contractor. On GOES, the story was that the performance will greatly improve with the delivery of the second GOES because there was a fair amount of learning with the first. It seems odd that that same logic wouldn't be applied to the second JPSS satellite.

In conclusion, NOAA needs to be more transparent on risks and satellite lifespans. There needs to be a consistent policy to evaluate satellite lifespans, not just for JPSS but also for GOES, and we still have major concerns with the backup, with the gap in the backup for GOES–R, and also between NPP and JPSS–1, but after GOES–R and JPSS–1 launch, given NOAA's recent extensions, we're really not concerned about gaps after that point. In fact, Congress might have opportunities to reduce annual expenditures on these programs in upcoming years.

I look forward to your questions.

[The prepared statement of Mr. Powner follows:]

United States Government Accountability Office

GAO

Testimony

Before the Subcommittees on Environment and Oversight, Committee on Science, Space, and Technology, House of Representatives

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ENVIRONMENTAL SATELLITES

Launch Delayed; NOAA Faces Key Decisions on Timing of Future Satellites

Statement of David A. Powner
Director, Information Technology Management Issues

GAO Highlights

Highlights of GAO-16-143T, a testimony before the Subcommittees on Environment and Oversight, Committee on Science, Space, and Technology, House of Representatives

Why GAO Did This Study

NOAA is procuring the next generation of polar and geostationary weather satellites to replace aging satellites that are approaching the end of their useful lives. GAO has reported that gaps in polar satellite coverage and in backup coverage for geostationary satellites are likely in the near future. Given the criticality of satellite data to weather forecasts, concerns that problems and delays on the new satellite programs will result in gaps in the continuity of critical satellite data, and the impact such gaps could have on the health and safety of the U.S. population, GAO added mitigating weather satellite gaps to its High-Risk List in 2013 and it remained on the list in 2015.

GAO was asked to testify, among other things, on the cause and impact of a recent launch delay on the GOES-R program, and the status and key remaining challenges on the JPSS program. To do so, GAO relied on prior reports issued from 2012 to 2015 as well as on ongoing work on both programs. That work included analyzing progress reports and interviewing officials.

What GAO Recommends

GAO is not making any new recommendations in this statement, but—since 2012—has made 23 recommendations to NOAA to strengthen its satellite acquisition programs and contingency plans. The department agreed with GAO's recommendations and is taking steps to implement them. To date, NOAA has implemented 6 recommendations and is working to address the remaining 17. Timely implementation of these recommendations will help mitigate program risks.

View GAO-16-143T. For more information, contact David A. Powner at (202) 512-9286 or pownerd@gao.gov.

December 10, 2015

ENVIRONMENTAL SATELLITES

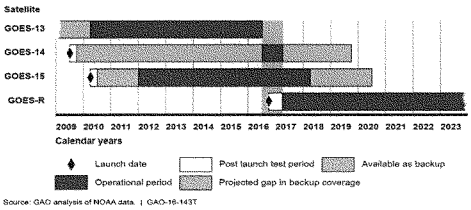
Launch Delayed; NOAA Faces Key Decisions on Timing of Future Satellites

What GAO Found

The National Oceanic and Atmospheric Administration's (NOAA) $10.9 billion Geostationary Operational Environmental Satellite-R (GOES-R) program recently delayed the planned launch of the first satellite in the new series from March 2016 to October 2016. Based on its ongoing work, GAO found that the decision to delay the launch was due to poor schedule performance over the last few years (losing more than 10 days a month on average), recent technical issues with key components, and little schedule margin as the program entered integration testing. The October 2016 launch date may also be delayed if additional technical challenges arise or if schedule performance remains poor.

NOAA recently changed assumptions about the expected lifespan of existing GOES satellites from 7 to 10 years based on the longevity of prior satellites. However, the analysis supporting this change is over 10 years old. Even with this extension, NOAA may fall short of its policy of having 2 operational satellites and 1 backup satellite in orbit. The agency faces an 11 month gap in backup coverage until GOES-R is operational, during which time there would be only 2 operational satellites (see figure). Any further delays in the GOES-R launch date could exacerbate that gap. NOAA is now facing important decisions on when to launch the remaining satellites in the GOES-R series to maximize satellite coverage while minimizing development and storage costs.

Timeline for a Potential Gap in Backup Geostationary Satellite Coverage



Source: GAO analysis of NOAA data. | GAO-16-143T

Based on its ongoing work, GAO found that NOAA's $11.3 billion Joint Polar Satellite System (JPSS) program is making progress toward the planned launch of the JPSS-1 satellite in March 2017. However, the program has experienced technical issues that have affected internal schedule deadlines, such as an issue with debris in an instrument's subsystem that delayed its delivery by approximately 8 months, and faces key risks in the remainder of development. NOAA is also facing the risk of a potential near-term gap in polar data prior to the launch of the JPSS-1 satellite. Similar to the decision on the GOES satellites, in April 2015, NOAA revised its assumptions about the expected life of the satellite that is currently in-orbit by adding up to 4 years, which would reduce the chance of a near-term gap. However, risks to the performance and health of the on-orbit satellite, and to development of the JPSS-2 satellite could increase the risk of a gap. Also, NOAA faces key decisions on timing the development and launch of the remaining JPSS satellites to ensure satellite continuity while balancing the possibility that satellites could last much longer than anticipated.

Chairmen Bridenstine and Loudermilk, Ranking Members Bonamici and Beyer, and Members of the Subcommittees:

Thank you for the opportunity to participate in today's hearing on two important satellite acquisition programs within the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA). Both the Geostationary Operational Environmental Satellite-R series (GOES-R) and the Joint Polar Satellite System (JPSS) are expected to replace current operational satellites as they near the end of their expected lifespans. Both programs are critical to the United States' ability to maintain the continuity of data required for weather forecasting.

As requested, this statement discusses (1) the GOES-R program: our prior concerns about the program's schedule, recent events that have delayed the planned launch date and their impact, and key decisions facing the program as it moves forward; and (2) the JPSS program: our prior findings on key risks and the potential for a satellite data gap, as well as the program's current status and key remaining challenges. To prepare this testimony, we relied on the work supporting our prior reports on GOES-R and JPSS.[1] More detailed information on our objectives, scope, and methodology for that work can be found in the issued reports. We also obtained information on the current status and key challenges facing the JPSS program through ongoing work we are doing for the full Committee, which is to be issued in spring 2016. We assessed documentation associated with NOAA's efforts to address our prior recommendations on both programs. Specifically, we analyzed program office documents on cost, schedule, and key risks, and assessed changes in assumptions on the longevity of existing satellites. We also interviewed program officials and key contractors. We confirmed facts and analyses presented in this statement with NOAA officials.

[1]GAO, *Geostationary Weather Satellites: Launch Date Nears, but Remaining Schedule Risks Need to be Addressed*, GAO-15-60 (Washington, D.C.: Dec. 16, 2014); *Polar Weather Satellites: NOAA Needs To Prepare for Near-term Data Gaps*, GAO-15-47 (Washington, D.C.: Dec. 16, 2014); *Polar Weather Satellites: NOAA Identified Ways to Mitigate Data Gaps, but Contingency Plans and Schedules Require Further Attention*, GAO-13-676 (Washington, D.C.: Sept. 11, 2013); *Geostationary Weather Satellites: Progress Made, but Weaknesses in Scheduling, Contingency Planning, and Communicating with Users Need to Be Addressed*, GAO-13-597, (Washington, D.C.: Sept. 9, 2013); and *Geostationary Weather Satellites: Design Progress Made, but Schedule Uncertainty Needs to be Addressed*, GAO-12-576, (Washington, D.C.: June 26, 2012); and *Polar-orbiting Environmental Satellites: Changing Requirements, Technical Issues, and Looming Data Gaps Require Focused Attention*, GAO-12-604 (Washington, D.C.: June 15, 2012).

All of our work was performed and is being conducted in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Since the 1960s, the United States has used geostationary and polar-orbiting satellites to observe the earth and its land, ocean, atmosphere, and space environments. Geostationary satellites maintain a fixed position relative to the earth from a high orbit of about 22,300 miles in space. In contrast, polar-orbiting satellites circle the earth in a nearly north-south orbit, providing global observation of conditions that affect the weather and climate. As the earth rotates beneath it, each polar-orbiting satellite views the entire earth's surface twice a day.

Both types of satellites provide a valuable perspective of the environment and allow observations in areas that may be otherwise unreachable. Used in combination with ground, sea, and airborne observing systems, satellites have become an indispensable part of monitoring and forecasting weather and climate. For example, geostationary satellites provide the graphical images used to identify current weather patterns and provide short-term warning. Polar-orbiting satellites provide the data that go into numerical weather prediction models, which are a primary tool for forecasting weather days in advance—including forecasting the path and intensity of hurricanes. These weather products and models are used to predict the potential impact of severe weather so that communities and emergency managers can help prevent and mitigate its effects.

Federal agencies are currently planning and executing major satellite acquisition programs to replace existing geostationary and polar satellite systems that are nearing the end of their expected life spans. However, these programs have troubled legacies of cost increases, missed milestones, technical problems, and management challenges that have resulted in reduced functionality and major delays to planned launch dates over time. We and others—including an independent review team reporting to the Department of Commerce and the department's Inspector General—have raised concerns that problems and delays with environmental satellite acquisition programs will result in gaps in the continuity of critical satellite data used in weather forecasts and warnings.

According to officials at NOAA, a polar satellite data gap would result in less accurate and timely weather forecasts and warnings of extreme events, such as hurricanes, storm surges, and floods. Such degradation in forecasts and warnings would place lives, property, and our nation's critical infrastructures in danger. The importance of having such data available was highlighted in 2012 by the advance warnings of the path, timing, and intensity of Superstorm Sandy.

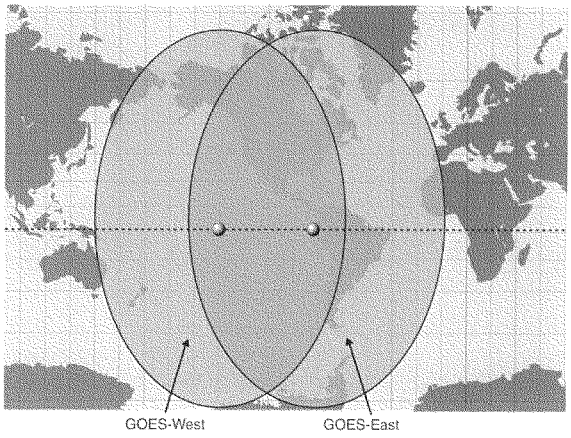
Given the criticality of satellite data to weather forecasts, concerns that problems and delays on the new satellite acquisition programs will result in gaps in the continuity of critical satellite data, and the impact of such gaps on the health and safety of the U.S. population, we concluded that the potential gap in weather satellite data is a high-risk area. We added this area to our High-Risk List in 2013 and it remained on the High-Risk List in 2015.[2]

The GOES-R Program: An Overview

NOAA operates a two-satellite geostationary satellite system that is primarily focused on the United States (see figure 1). The GOES-R series is the next generation of satellites that NOAA is planning; the satellites are planned to replace existing weather satellites. The ability of the satellites to provide broad, continuously updated coverage of atmospheric conditions over land and oceans is important to NOAA's weather forecasting operations.

[2]Every 2 years, at the start of a new Congress, we call attention to agencies and program areas that are high risk due to their vulnerabilities to fraud, waste, abuse, and mismanagement, or are most in need of transformation. See GAO, *High Risk Series: An Update*, GAO-13-283 (Washington, D.C.: Feb. 14, 2013) and *High Risk Series: An Update*, GAO-15-290 (Washington, D.C.: Feb. 11, 2015).

Figure 1: Approximate Geographic Coverage of the Geostationary Operational Environmental Satellites (GOES)



Source: NOAA (data), Mapart (map). | GAO-16-143T

NOAA is responsible for GOES-R program funding and overall mission success, and has implemented an integrated program management structure with the National Aeronautics and Space Administration (NASA) for the GOES-R program. Within the program office, there are two project offices that manage key components of the GOES-R system. NOAA has delegated responsibility to NASA to manage the Flight Project Office, including awarding and managing the spacecraft contract and delivering flight-ready instruments to the spacecraft. The Ground Project Office, managed by NOAA, oversees the Core Ground System contract and satellite data product development and distribution.

The program estimates that the development for all four satellites in the GOES-R series will cost $10.9 billion through 2036. In 2013, NOAA announced that it would delay the launch of the GOES-R and S satellites from October 2015 and February 2017 to March 2016 and May 2017, respectively.

Since 2012, we have issued three reports on the GOES-R program that highlighted management challenges and the potential for a gap in backup satellite coverage.[3] In these reports, we made 12 recommendations to NOAA to improve the management of the GOES-R program. These recommendations included improving satellite contingency plans, addressing shortfalls in defect management, and addressing weaknesses in scheduling practices. The agency agreed with these recommendations.

As of October 2015, the agency implemented 4 of these recommendations and is working on the remaining 8 recommendations. For example, NOAA improved its geostationary satellite contingency plan and improved its risk management processes. Also, while NOAA has made progress by improving selected practices, it has not yet fully implemented our recommendation to address multiple weaknesses in its scheduling practices. For example, the agency included subcontractor activities in its core ground schedule, but has not yet provided details showing a realistic allocation of resources. We have ongoing efforts to assess the agency's progress in addressing the open recommendations.

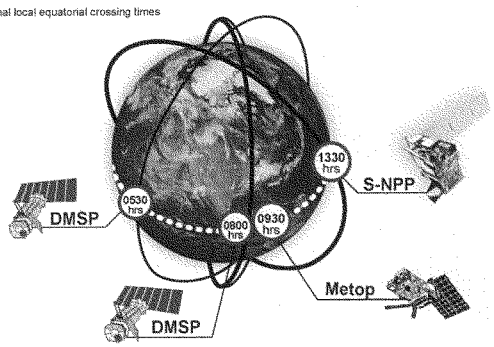
The JPSS Program: An Overview

In addition to the geostationary satellite constellation, for over 40 years, the United States has operated two separate operational polar-orbiting meteorological satellite systems: the Polar-orbiting Operational Environmental Satellite series, which is managed by NOAA, and the Defense Meteorological Satellite Program (DMSP), which is managed by the Air Force. Currently, there is one operational Polar-orbiting Operational Environmental Satellite (called the Suomi National Polar-orbiting Partnership, or S-NPP) and two operational DMSP satellites that are positioned so that they cross the equator in the early morning, midmorning, and early afternoon. In addition, the government relies on data from a European satellite, called the Meteorological Operational satellite, or Metop.[4] Figure 2 illustrates the current operational polar satellite constellation.

[3]See GAO-15-60, GAO-13-597, and GAO-12-576.

[4]The European Organisation for the Exploitation of Meteorological Satellites' Metop program is a series of three polar-orbiting satellites dedicated to operational meteorology. Metop satellites are planned to be flown sequentially over 14 years. The first of these satellites was launched in 2006, the second was launched in 2012, and the final satellite in the series is expected to launch in 2017.

Figure 2: Configuration of Operational Polar Satellites



Sources: GAO, based on NPOESS Integrated Program Office, NOAA, and DOD data; NASA/Goddard Space Flight Center Scientific Visualization Studio (earth), S-NPP image provided courtesy of University of Wisconsin-Madison Space Science and Engineering Center. | GAO-16-143T

Note: DMSP—Defense Meteorological Satellite Program; Metop—Meteorological Operational (satellite); S-NPP—Suomi National Polar-orbiting Partnership; NPOESS—National Polar-orbiting Operational Environmental Satellite System; NOAA—National Oceanic and Atmospheric Administration; DOD—Department of Defense; and NASA—National Aeronautics and Space Administration.

A May 1994 Presidential Decision Directive[5] required NOAA and the Department of Defense (DOD) to converge the two satellite programs into a single satellite program—the National Polar-orbiting Operational Environment Satellite System (NPOESS)—capable of satisfying both civilian and military requirements. However, in the years after the program was initiated, NPOESS encountered significant technical challenges in sensor development, program cost growth, and schedule delays.

Faced with costs that were expected to reach about $15 billion and launch schedules that were delayed by over 5 years, in February 2010, the Director of the Office of Science and Technology Policy announced that NOAA and DOD would no longer jointly procure NPOESS; instead,

[5]Presidential Decision Directive NSTC-2, May 5, 1994.

each agency would plan and acquire its own satellite system. Specifically, NOAA would be responsible for the afternoon orbit, and DOD would be responsible for the early morning orbit.

When this decision was announced, NOAA and NASA began planning for a new satellite program in the afternoon orbit—called JPSS. In 2010, NOAA established a program office to guide the development and launch of the S-NPP satellite[6] as well as the two planned JPSS satellites, known as JPSS-1 and JPSS-2. NOAA's current life cycle cost baseline for the JPSS program is $11.3 billion through fiscal year 2025. The current anticipated launch dates for JPSS-1 and JPSS-2 are March 2017 and December 2021, respectively. More recently, NOAA has also begun planning the Polar Follow-On program, which is to include the development and launch of a third and fourth satellite in the series. These satellites are planned to be nearly identical to the JPSS-2 satellite.

Since 2012, we have issued three reports on the JPSS program that highlighted technical issues, component cost growth, management challenges, and key risks.[7] In these reports, we made 11 recommendations to NOAA to improve the management of the JPSS program. These recommendations included addressing key risks and establishing a comprehensive contingency plan consistent with best practices. The agency agreed with these recommendations.

As of October 2015, the agency has implemented 2 recommendations and was working to address the remaining 9 recommendations. Specifically, NOAA established contingency plans to mitigate the possibility of a polar satellite data gap and began tracking completion dates for key risk mitigation activities. NOAA also took initial steps to improve its scheduling practices, contingency plans, and assessment of the potential for a gap. We have ongoing work reviewing the agency's efforts to fully implement these open recommendations, and plan to issue our report in spring 2016.

[6]S-NPP was originally planned as a demonstration satellite, but due to schedule delays that had the potential to lead to satellite data gaps, NOAA made the decision to use it as an operational satellite. This means that the satellite's data is used for climate and weather products.

[7]See GAO-15-47, GAO-13-676, and GAO-12-604.

Prior Schedule Concerns Were Warranted; GOES-R Program Delayed Its Committed Launch Date and Faces Important Decisions on How to Proceed

As previously noted, we have issued a series of reports on the GOES-R program that highlighted schedule delays, management challenges, and the potential for a gap in backup satellite coverage.[8] In these reports, we found that technical issues had caused a series of delays to major program milestones, which in turn had the potential to affect the GOES-R satellite's launch readiness date. In 2012 and 2013, we made recommendations to NOAA to strengthen its scheduling practices. While the agency is making progress on these recommendations, they have not yet been fully implemented.

Most recently, in December 2014, we reported that the GOES-R program had made significant progress in developing its first satellite, including completing testing of the satellite instruments. However, we also reported that even though NOAA had delayed the launch of the GOES-R satellite from October 2015 to March 2016, the program continued to experience schedule delays that could affect the new launch date.[9] Specifically, the program had delayed multiple key reviews and tests, with delays ranging from 5 to 17 months. We also reported that the program's actions to mitigate its schedule delays introduced further risks, which could increase the extent of the delays. For example, the program attempted to mitigate delays in developing detailed plans for ground-based data operations by performing system development while concurrently working on the detailed plans. In addition, the program compressed its testing schedule by performing spacecraft integration testing 24-hours-a-day, 7-days-a-week. As we reported previously, methods such as conducting planning and development work concurrently and compressing test schedules are activities that increase the risk of further delays because there could be too little time to resolve any issues that arise. At the time of our report, program officials acknowledged that they could not rule out the possibility of further delays, and that these delays could affect the planned March 2016 launch date.

[8]See GAO-12-576, GAO-13-597, and GAO-15-60.

[9]GAO-15-60.

Other entities, including a NOAA standing review board and the Department of Commerce's Inspector General, shared these concerns. In late 2014, NOAA's standing review board noted that the program's plan for the remaining integration and testing activities was very aggressive, and that additional failures and subsequent rework could threaten the then-expected planned launch date in early 2016. In May 2015, the Inspector General expressed concerns about the program's lagging progress and reported that the program needed to proactively address testing risks in order to maintain its launch schedule.[10]

Based on information collected during our ongoing work, these prior concerns about the program schedule were warranted. The program continued to experience poor schedule performance as it moved-through integration and testing. Program data show that the program lost more than 10 days of schedule reserve each month, on average, between July 2013 and July 2015. When asked about this poor schedule performance, program officials stated several reasons, including the complexity of the satellite build, the difficulties faced as part of a first-time build, and that the testing schedule was extremely aggressive. The monthly loss in margin occurred even though the program introduced steps designed to minimize a loss in reserves, such as switching to round-the-clock testing, eliminating selected tests, and implementing process and management changes. In October 2015, program officials reported that schedule performance improved for the month of September.

GOES-R Satellite Launch Date Delayed; NOAA Extends the Expected Lifespans of Current Satellites, but the Risk of a Gap in Backup Coverage Remains

In August 2015, NOAA decided to delay the planned launch date of the first GOES-R satellite from March 2016 to October 2016. While previously reported schedule delays contributed to this decision by decreasing the overall amount of available schedule reserves, program officials noted several other reasons for this decision. These reasons included finding debris in the solar array drive assembly[11] that required them to replace the component, needing additional spacecraft repair and rework after

[10]U.S. Department of Commerce Office of the Inspector General, *National Oceanic and Atmospheric Administration: Audit of the Geostationary Operational Environmental Satellite–R Series: Leadership Must Proactively Address Integration and Test Risks to Maintain Revised Launch Schedule*, OIG-15-030-A (Washington, D.C.: May 28, 2015).

[11]The solar array drive assembly is a rotating mechanism which passes power from the solar panel array to the GOES-R instruments.

testing was completed, and resolving disconnects in the expected duration of tasks at the launch site. NOAA also considered the likelihood of future delays in thermal vacuum testing, which is considered to be one of the more difficult environmental tests. NOAA officials stated that they chose the new launch date because it was the next available launch slot at the Kennedy Space Center and was consistent with expectations on when the GOES-R satellite would be ready to launch.[12]

Based on findings from our ongoing work, recent events have increased the risk of achieving the October 2016 launch date. In September 2015, NOAA identified a new technical issue in a component that helps regulate and distribute the satellite's power supply.[13] To try to address this issue, the GOES program replaced the component on the GOES-R satellite with the same component from GOES-S, the next satellite in the series. The program has experienced delays as a result of the need to replace and retest this component, and it is not yet clear that this switch will address the problem. According to a recent NOAA review of the program, this issue, along with several other issues discovered in testing, has put the new October 2016 launch date at risk. In late 2015, NOAA officials plan to reassess the schedule leading up to the planned launch date. Program officials stated that if GOES-R does not launch in October 2016, another launch slot would likely be available by May 2017.

NOAA Extended the Expected Life Span of Its Operational Satellites, but the Agency Continues to Face a Potential Gap in Backup Satellite Coverage

NOAA's policy for geostationary satellites is to have two operational satellites and one backup satellite in orbit at all times. Three viable GOES satellites—GOES-13, GOES-14, and GOES-15—are currently in orbit. Both GOES-13 and GOES-15 are operational satellites, with GOES-13 covering the eastern United States (GOES-East in figure 1, on page 4) and GOES-15 covering the western United States (GOES-West in figure 1). GOES-14 is currently in an on-orbit storage mode and is available as a backup for the other two satellites should they experience any degradation in service. As we previously reported, this backup policy proved useful on two previous occasions when the agency experienced

[12]The October 2015 launch slot became available because the mission which previously had that slot wanted to launch sooner.

[13]This component is called the Scalable Power Regulation Unit.

problems with one of its operational satellites, and was able to move its backup satellite into place until the problems had been resolved.[14]

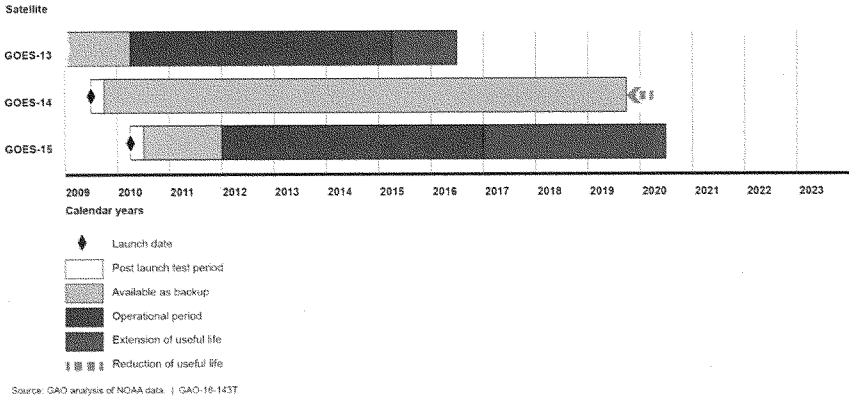
Based on ongoing work, we found that NOAA recently decided to change its assumptions about the lifespan of the currently operational GOES satellites. The satellites were originally designed to have a 7-year life, consisting of 5 operational years and 2 years in storage. NOAA officials stated that, in April 2015, the agency revised its expectations for the total life for the GOES-13, GOES-14, and GOES-15 satellites to 10 years (including both operational and storage years). On October 21, 2015, the Deputy Assistant Administrator for Systems in NOAA's National Environmental Satellite, Data, and Information Service informed us that the decision to change the lifespan was based on an analysis performed in 2005 that showed a 3-year extension was reasonable. At that time, NOAA chose to continue to depict the shorter lifespan due to its judgment of overall risk. The Deputy Assistant Administrator stated that in spring 2015, NOAA determined that it had sufficient history and performance on the GOES-13 and 15 satellites to begin reflecting the 10-year lifespan in its planning documents. This change had the effect of increasing the expected life of GOES-13 and GOES-15 from the previous estimate, and slightly decreasing the expected life of GOES-14.[15] Figure 3 shows the original and extended estimates of the useful lives of the geostationary satellite constellation.

If NOAA had not made the decision to extend its expectation of the useful life of GOES-15, the recent delay in the GOES-R launch could have put NOAA at risk of a coverage gap in early 2017. With the change in assumptions, NOAA officials now expect that there will be coverage of the GOES-East and West satellite positions through 2019 regardless of when the GOES-R series of satellites are available.

[14]GAO-15-60.

[15]GOES-14 was launched in June 2009 and has served as the backup satellite in on-orbit storage for the 6 years since that time. Combining the actual storage time with the anticipated 5-year operational period exceeded NOAA's new assumption of a 10-year lifespan. Thus, the change to an estimated 10-year life is slightly less than NOAA's prior plans for GOES-14.

Figure 3: NOAA's Expected Life Span of Geostationary Satellites Currently in Orbit



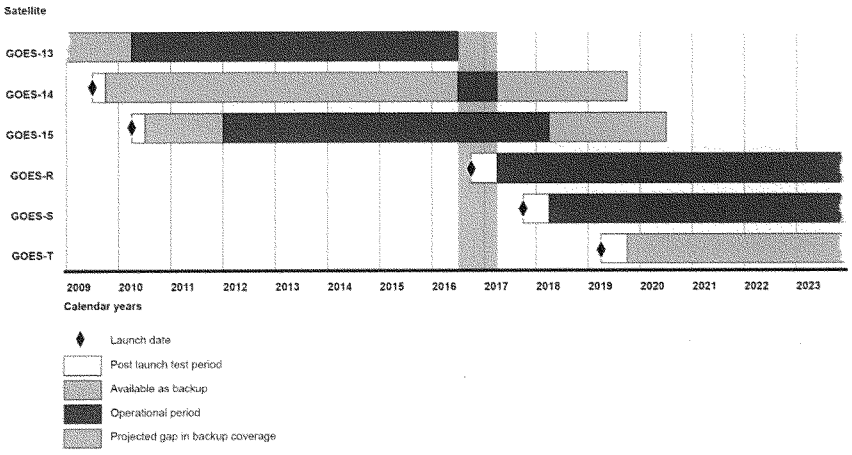
Source: GAO analysis of NOAA data. | GAO-16-143T

Note: NOAA moved the estimated useful life for the GOES-14 satellite from early 2020 to mid-2019 in the most current estimate.

However, the risk of a gap in backup satellite coverage remains. In December 2014, we reported that the geostationary satellite constellation was at risk of a gap in backup coverage, based on the GOES-R launch date of March 2016.[16] This risk is increased by moving the launch date to October 2016 or later. The GOES-13 satellite, which has experienced issues with 4 of 11 subsystems and had previously been taken offline twice, is still expected to reach the end of its useful life in mid-2016. If GOES-R were to launch in October 2016, and then undergo a 6-month on-orbit checkout period, it would begin operations in April 2017, close to a year after the expected end of GOES-13's useful life. Figure 4 shows the backup gap based on current assumptions of satellite life. Any further delays in the GOES-R launch date would increase this gap in backup coverage, which could mean a gap in coverage if one of the primary operational satellites were to fail.

[16]GAO-15-60.

Figure 4: Potential Gap in Geostationary Operational Environmental Satellite Backup Coverage, as of October 2015



Source: GAO analysis of NOAA data. | GAO-16-143T

Note: NOAA has a policy requiring two operational and one backup satellite in orbit. This chart shows a potential gap in backup satellite coverage for the period leading up to when GOES-R is operational. This chart also makes the assumption that GOES-S will begin operation immediately at the end of its post-launch test period. However, NOAA has not yet decided when it will put GOES-S into operation.

NOAA Faces Significant Decisions on Building, Storing, and Launching Future Geostationary Satellites

NOAA now faces a series of significant decisions on the development, launch, and maintenance of its GOES-R series satellites. Based on our ongoing work, these decisions include the following:

- **Determine how to manage schedule risks to ensure GOES-R launches on schedule.**

  NOAA and the GOES program continue to experience issues in completing integration and testing of the GOES-R satellite. NOAA officials have stated that the program was still losing about 10 reserve

days per month through August 2015. As of September 2015, the program had 113 days of schedule reserve, which is 43 days more than suggested by NASA's guidelines. Program officials expect the monthly loss of schedule reserve to decrease because they are using more realistic estimates of how long tasks will take based on past performance. However, given the potential for a gap in backup coverage leading up to the time that GOES-R is in orbit and operational, NOAA continues to look for ways to minimize remaining schedule risks on the GOES-R satellite. As previously noted, we made recommendations to NOAA in 2012 and 2013 to improve schedule management practices; these recommendations remain open today.[17] Timely implementation of our recommendations could help to mitigate program risks.

- **Determine when GOES-S should be launched.**

  NOAA's current plans to launch GOES-R in October 2016 and to launch GOES-S in May 2017 would allow 7 months between launch dates. However, NOAA officials would prefer to maintain a 14-month interval between the launch dates of these two satellites. Officials have stated that this interval is necessary due to the limited number of qualified personnel that work to develop both satellites, the need to rebuild the hardware planned for GOES-S that will now be used on GOES-R, and to allow adequate time for test and checkout of the GOES-R satellite before launching GOES-S. In late 2015 or early 2016, NOAA plans to conduct a detailed schedule analysis on GOES-S development. From this analysis, NOAA plans to decide whether to move the GOES-S planned May 2017 launch date to a later time.

- **Decide the appropriate spacing of the GOES-T and GOES-U satellite launches to ensure satellite coverage and minimize costs.**
  In addition to GOES-R and GOES-S, NOAA has established planned launch dates for the final two satellites in the GOES-R series. GOES-T is planned for launch in April of 2019, and GOES-U is planned for launch in October 2024. Key questions exist about the optimal timing for these later satellites.

  Program officials believe that it would be best to develop and launch the GOES-T satellite as soon as possible to sustain NOAA's policy of

[17]See GAO-12-576 and GAO-13-597.

having two operational satellites and one spare satellite on-orbit and to obtain the enhanced functionality these satellites offer. NOAA officials are considering options related to delaying the development of the GOES-U satellite or developing it and putting it into storage.

Alternatively, delaying the development of GOES-T and GOES-U could result in cost efficiencies. For example, if the GOES-R and S satellites last for a minimum of 10 years, NOAA could be in the position of storing GOES-U on the ground for an extended time. NOAA officials stated that they would consider a later launch date for GOES-U depending on the health of the satellite system when it is due to launch. Storing satellites on the ground is costly and requires maintenance to ensure the satellites function once finally launched. Delaying the development of GOES-U would both reduce storage costs and delay annual costs associated with these satellites' development. Moving forward, thoroughly assessing the relative costs and benefits of various launch scenarios will be important.

The JPSS Program Is Making Progress; Key Risks Remain in Meeting the March 2017 Launch Date

In December 2014, we reported that the JPSS program had completed significant development work on the JPSS-1 satellite and had remained within its cost and schedule baselines.[18] However, we noted that the program had encountered technical issues on a key component that led to cost growth and a very tight schedule. We also noted that while the program reduced its estimate of a near-term gap in satellite data, this gap assessment was based on incomplete data. We recommended that NOAA update its assessment of potential polar satellite data gaps to include more accurate assumptions about launch dates.

We also assessed NOAA's efforts to improve its satellite contingency plan and to implement mitigation activities. Specifically, we reported that while NOAA improved its polar satellite contingency plan by identifying mitigation strategies and actions, the contingency plan had shortfalls when compared to best practices. For example, the plan did not include an assessment of available mitigation alternatives based on their cost and impact. Moreover, NOAA was not providing consistent or comprehensive reporting of its progress on all mitigation projects. As a result, NOAA had

[18]GAO-15-47.

less assurance that it was adequately prepared to deal with a gap in polar satellite coverage. We recommended that NOAA revise the polar satellite contingency plan to, among other things, include an assessment of available alternatives based on their costs and potential impacts, and ensure that the relevant entities provide monthly and quarterly updates on the progress on all mitigation projects and activities. We currently have ongoing work for your Committee assessing NOAA's efforts to address each of these recommendations, and we plan to report our results by spring 2016.

NOAA Is Planning to Launch the JPSS-1 Satellite in 2017, but Continues to Face Schedule and other Risks

Based on our ongoing work, NOAA and the JPSS program continue to make progress towards the launch of the JPSS-1 satellite as a replacement for the currently on-orbit S-NPP satellite. Since 2013, the program's life cycle cost baseline through 2025 has remained stable at $11.3 billion, and the launch date has remained set for March 2017.

While the launch date has not changed, the JPSS program has experienced technical issues that have affected internal schedule deadlines. For example, the expected completion date of the Advanced Technology Microwave Sounder instrument was recently delayed from March 2015 to November 2015, due to foreign object debris in a key subsystem. NOAA has also experienced delays in completing a needed upgrade that will allow the JPSS ground system to provide command, telemetry, and data processing for more than one JPSS-class satellite, a capability that will become necessary when both S-NPP and JPSS-1 are in orbit.

In addition to these ongoing technical issues, there is the possibility of conflicts with the GOES-R program for both resources and facilities as both programs complete testing at the NOAA Satellite Operations Facility. NOAA officials stated that they are aware of this issue and are taking steps to mitigate needs for common resources.

The Possibility of a Gap in Polar Satellite Data Remains; JPSS Program Faces Key Risks, and Decisions Are Needed on Developing and Timing Future Satellites

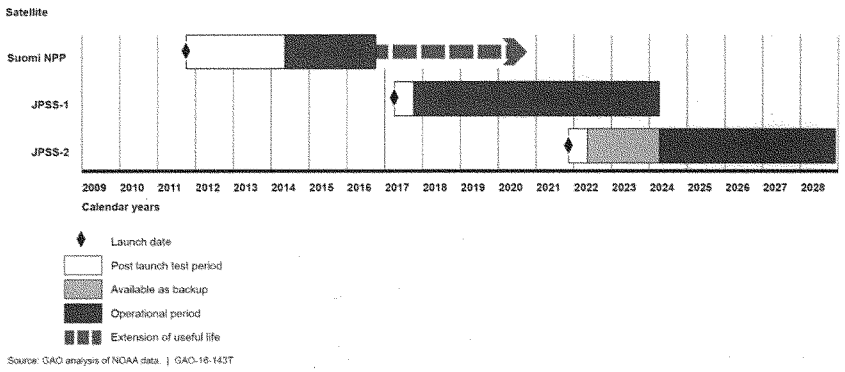
We previously reported that NOAA is facing a potential near-term gap in polar data between the expected end of useful life of the S-NPP satellite and the launch of the JPSS-1 satellite. As of December 2014, NOAA officials stated that a 3-month gap was likely based on an analysis of the availability and robustness of the polar constellation. However, we reported that several factors could cause a gap to occur sooner and last

longer—potentially up to several years.[19] For example, if S-NPP were to fail today—exactly 4 years after its launch—the agency would face a gap of about 23 months before the JPSS-1 satellite could be launched and put into operation. Concerns about a near-term gap will remain until the JPSS-1 satellite is launched and operational. Further, if JPSS-1 fails on launch, there could be a gap until JPSS-2 is launched and operational in mid-2022.

In April 2015, based on an updated analysis of its performance over time, NOAA decided to extend the expected life of the S-NPP satellite. Specifically, NOAA officials estimated that S-NPP would last as long as 9 years, up from its initial estimate of 5 years. Should S-NPP last for 9 years, it could alleviate a potential near-term gap. NOAA provided us with an assessment of the S-NPP satellite's availability over time, and we have ongoing work analyzing the assessment. Figure 5 shows the original and extended estimates of the useful lives of the S-NPP and first two JPSS satellites.

[19]GAO-15-47.

Figure 5: NOAA's Expected Life Span of Current Satellites in Joint Polar Satellite Program



Source: GAO analysis of NOAA data. | GAO-16-143T

While NOAA's changes in assumptions on how long S-NPP will last may lessen the likelihood of a near-term data gap, our ongoing work shows that the JPSS program continues to face key risks which could increase the possibility of a gap.

- **Risks to the currently on-orbit satellite:** The S-NPP satellite continues to experience isolated performance issues. For example, a mechanical component that facilitates the collection of sounding data on the S-NPP Advanced Technology Microwave Sounder instrument experienced electrical currents that were higher than expected in early 2015. While program officials believe that the issue has been addressed, the JPSS program is carrying it as a risk because it could affect the satellite's useful life. There is also a risk that space debris could collide with S-NPP,[20] which will not factor into NOAA availability calculations until its 2015 analysis is complete.
- **Risks to satellites in development:** As discussed above, the JPSS program is currently dealing with technical issues on both the flight

[20]NOAA officials noted that while a collision with space debris is possible, they have not observed any debris impacts. They have, however, maneuvered the satellite to avoid debris.

and ground components of the JPSS-1 satellite which have caused schedule delays and decreased the remaining margin to launch. In addition, NOAA switched to a new spacecraft contractor beginning with the JPSS-2 satellite. With a new contractor, it may be more difficult to apply lessons learned from issues in JPSS-1 development if similar issues arise on JPSS-2.

Moving forward, NOAA also faces decisions on timing the development and launch of the remaining satellites in the JPSS program. The design life of the JPSS satellites is 7 years and NOAA plans, beginning with JPSS-2, to launch a new satellite every 5 years in order to achieve a robust constellation of satellites. However, NOAA officials stated that they expect the satellites to last 10 years or more. If the satellites last that long, then there could be unnecessary redundancy. If they do not, then there is an increased potential for future gaps in polar satellite coverage, as there will be several periods in which only one satellite is on orbit. Similar to its geostationary program, evaluating the costs and benefits of different launch scenarios to ensure robust coverage while decreasing unnecessary costs will be important.

In summary, we have made multiple recommendations to NOAA to improve management of the GOES-R and JPSS satellite programs and to address weaknesses in contingency plans in case of a gap in satellite coverage. NOAA has addressed about a quarter of our recommendations to date; it is important that the agency expedite its efforts to address the remaining ones in order to reduce existing risks and strengthen its programs.

NOAA recently decided to delay the GOES-R satellite launch until October 2016 and to change its assumption for how long the currently operational satellites will last. Even with the new assumption that existing satellites will last longer, the risk remains that there will be a gap in backup satellite coverage that lasts for almost a year. The agency is now facing important decisions on how to achieve the new launch schedule and how to space out future satellites to ensure satellite coverage while minimizing costs.

Regarding the JPSS program, NOAA continues to make progress developing and testing the JPSS-1 satellite as it moves toward a March 2017 launch date. Moreover, NOAA decided to extend its expectation for how long the current satellite will last. However, there is the potential for a

coverage gap should the currently on-orbit satellite not last until the launch and calibration of the JPSS-1 satellite is completed. According to NOAA officials, it is also possible that JPSS-1 and -2 will last longer than anticipated. Moving forward, reconsidering development and launch calendars to ensure robust satellite coverage while decreasing unnecessary costs will be important.

Chairmen Bridenstine and Loudermilk, Ranking Members Bonamici and Beyer, and Members of the Subcommittees, this completes my prepared statement. I would be pleased to respond to any questions that you may have at this time.

GAO Contacts and Staff Acknowledgments

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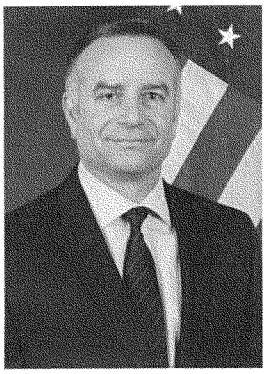
Biography



David A. Powner is the Director of Information Technology Management Issues at the U.S. Government Accountability Office (GAO). Dave has more than twenty-five years' experience in both the public and private sectors.

Dave is currently responsible for a large segment of GAO's information technology work that focuses on large-scale system acquisitions, IT governance, operational systems management, and various IT reform initiatives (e.g., IT Dashboard, data center consolidation, portfolio management, cloud computing).

In the private sector, Dave held several executive-level positions in the telecommunications industry including overseeing IT and financial internal audits and software development associated with high speed internet systems.

At GAO, he has led teams reviewing major modernization efforts at Cheyenne Mountain Air Force Station, the National Weather Service, the Federal Aviation Administration, and the Internal Revenue Service. He has also led GAO's work on weather satellite acquisitions, cyber critical infrastructure protection, and health IT.

Dave has testified before Congress more than 80 times over the past several years. These and other GAO products have led to billions of dollars in taxpayer savings and improvements to a wide range of IT acquisitions and operations. Dave has received several GAO awards for his work, including several associated with Congressional service. Outside of GAO, he received Federal Computer Week's Federal 100 award in 2008 and again in 2012.

Dave holds a bachelor's degree in business administration from the University of Denver and attended the Senior Executive Fellows Program at the John F. Kennedy School of Government at Harvard University.

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Chairman BRIDENSTINE. Thank you, Mr. Powner, for your testimony. I recognize myself for five minutes for questions.

I just wanted to go back to Dr. Volz. The commercial space policy I think is a great starting point. I think there's more information that needs to be forthcoming on how to actually interact with NOAA on the commercial capabilities that are out there right now.

One of my questions is, right now when it comes to GPS radio occultation, we already have one company with satellites in space that are being tested and validated through UCAR, and we have other companies that are going to be launching next year numerous satellites into space. We heard testimony from you, and it's in your written testimony as well, about the COSMIC program. When we think about commercial applications, when we think about the 2010 Space Policy, Commercial Space Policy, would it not be appropriate to take advantage of these commercial opportunities rather than continue to develop COSMIC for however many millions of dollars that that's going to take?

Dr. VOLZ. So related to the value, the capabilities of the oncoming commercial capabilities, you mentioned we do have assets now in space. Spire is one organization that has launched some satellites, and there are several others that are likely to launch in the near term, and from the NOAA perspective, we're very interested in seeing the performance of these satellites demonstrated on orbit.

The COSMIC program that was launched first in 2006 and has been flying for many years providing radio occultation to NOAA and integrated into our numerical weather modeling is a proven and demonstrated performance capability that we have been taking advantage of. The COSMIC–2 is an extension of that, and we expect when the launch occurs in about a year, to add those observations into our data system. The value, the potential value of these new commercial ventures are very high but it's still potential, and I see we should be engaged with them, we should be watching and observing and analyzing the data that come from them once we develop the appropriate interaction engagement mechanism, but it should be compared against some standard, some measurement capability that we have as well with COSMIC already.

So I think that "both and" is the approach I would take in approaching these. I think we need the COSMIC–2 because it continues a necessary measurement and it will provide an excellent benchmark for comparison for these alternative approaches which use the same method, the same measurement technique but a different implementation. So validating those on-orbit activities and observations will be key as we go forward, and I look forward to the opportunity to do that.

Chairman BRIDENSTINE. Your boss, Manson Brown, last month here in DC. at a business roundtable mentioned that he supports a line item in the President's budget request for a tech demonstration of commercial satellite weather data. Do you also support a line item for commercial satellite weather data?

Dr. VOLZ. I support my boss, which is a good start. I do support——

Chairman BRIDENSTINE. Good idea.

Dr. VOLZ. —the principle that we do need a focused effort to demonstrate the capability of these operations. So yes, I would sup-

port that. We've been working with NOAA, on a commercial policy that went out and is now being reviewed for updates, on the NESDIS side, as we do the actual implementation. We've been working on a process, an engagement process, for how we would work with industry, work with potential vendors to provide data, to secure data, to evaluate the data when it comes in and then decide whether it's capable of supporting the long-term operational contract or contractual mechanism. We had a workshop this Monday, which was well attended by at least three of the radio occultation potential providers, to talk about how we can have a productive interaction and how we can have a relationship going forward to support what would be a demonstration project which could eventually lead to a sustained operational delivery of data.

Chairman BRIDENSTINE. The line item that Manson Brown talked about, any idea of what that dollar amount might be that is going to be in the President's budget request?

Dr. VOLZ. I would be speaking from one-half of the equation if I knew because I know what it takes for me to develop a satellite and to develop and to process the data, and that's what we're focusing on, what it would take for us to evaluate and to process the data.

As far as what the commercial side would need as an investment or procurement is a part that we still have to explore. So I'm not sure what would be the appropriate price point for our vendors to make their business models close because obviously that's a very proprietary element.

Chairman BRIDENSTINE. So——

Dr. VOLZ. It's an engagement we need to have to get a better feel for that.

Chairman BRIDENSTINE. Right, and I would encourage you to engage with those vendors.

The great thing for the taxpayer and for the people on this Committee is that those commercial vendors are launching into space right now with clients that aren't necessarily NOAA, and that gives us an opportunity to share the costs so that it's not just the U.S. government taking on the burden but also transportation companies, agricultural companies, insurance companies, et cetera, that are interested in this kind of data. So the price point may be a lot less than what we anticipate, and you know, the idea that they're making, you know, the business case without the government involved is positive as well, which only makes it that much more interesting for us to be willing to reach out and purchase that data.

I am out of time. I recognize the Ranking Member, Mr. Beyer, for five minutes.

Mr. BEYER. Thank you, Mr. Chairman, very much.

Dr. Volz, I have a culture question for you, and it's not a hostile question, just to warn you up front. Now, Mr. Powner talked about "extremely poor schedule performance" on one aspect of this. I read all Rick Atkinson's trilogy on the war in Europe, World War II, and Eisenhower again and again gave impossible timelines to his generals for invasions of North Africa, Sicily, Italy and Normandy. If you read Walter Isaacson's book on Steve Jobs, Jobs again and again gave his team impossible tasks.

So the question is, does NOAA surge? Do people work nights and weekends? Is there a sense of urgency about these things, and how is that urgency modeled by the leadership? Or is it business as usual, people come in at 9 on Monday morning and go home at 5 on Friday afternoon?

Dr. VOLZ. So starting with the ending of what you just stated, I've not seen a more dedicated team working on any program that I've seen on GOES–R and JPSS, and that's independent of whether they're NASA, NOAA, Lockheed Martin, Ball Aerospace, any of our vendors. So there's no sense of casual execution of the program. There's a strong dedication to the mission and to the time and the effort they put into it, well beyond what I could ever expect to tell them to do.

So your observation related to, is it a culture of setting unrealistic deadlines and expectations, we're very sensitive, I'm very sensitive to that. If you set a schedule which is unachievable from day one, then nobody treats it seriously. If I'm already behind the eight ball, then it doesn't matter if I work extra or not. So it is a negative impact, I think, on performance.

On GOES–R, when we set up the program some time ago, we have standard methodologies within NASA and NOAA about cost confidence and schedule confidence and probability of success. It's called a Joint Confidence Level, JCL for cost and schedule, and there's usually an acceptance that you budget to about a 70 percent confidence which means seven out of ten missions will meet or exceed that and three out of ten will need more time or more money, or both. That's sort of the baseline approach, assuming that you will perform to that.

On GOES–R, sometimes you choose a more aggressive schedule for a planetary mission because you have a tight window for launch. For the GOES–R program, we chose to proceed from our confirmation on first delivery on a 50 percent or thereabouts confidence schedule knowing it was aggressive but not unachievable because we understood the criticality of getting this measurement on orbit and because we thought we would challenge ourselves and we would track our performance against that. We never sacrificed the performance during that process so we didn't skip tests that we thought were important or necessary in order to achieve that but we tracked then the reserve depletion of our time. And as David Powner mentioned, the negative performance over about two years from mid-2013 to mid-2015 were strong. We were not meeting our schedule but we were still meeting the earliest schedule we could achieve.

Mr. BEYER. Let me try to fit one more question in here too, Dr. Volz.

So Mr. Powner, the GAO had made 11 recommendations regarding JPSS, and NOAA's only implemented two of them, and 12 recommendations regarding GOES–R, and NOAA's implemented four of those. Can you explain the gap between the recommendations made by GAO and the ability to respond?

Mr. POWNER. Yeah, a lot of those recommendations are to address the gap. It's on the contingency planning efforts, and Dr. Volz and I had a good conversation about this. I think a lot of them are in flight. They're not fully wrapped up yet, so we want to see more

of that done to address a lot of the gaps. I think the issue with this poor schedule performance and whether it's achievable or not, I think we need to be more open with our risks. So when we were here in February talking about missed milestones on the GOES–R program, and we didn't think they were going to hit that launch date of March 2016, and NOAA had data saying that we had poor schedule performance for two years. Our point is that you need to be open with your risks in order to hit your dates. When you're open with your risks—and I know this Committee's been very supportive of NOAA to ensure that these satellites get up there on time—we need to collectively work on these risks and be open with them so that we can all collectively address the issues that are at hand.

Mr. BEYER. Thank you.

And very quickly, Dr. Volz, on the life plan extension, Mr. Powner talked about NOAA should have disclosed that sooner, that that data's been around since 2005, it almost, if I were a skeptical person, I think we'd extended the lifespan in order to make sure that we don't look like there's a gap. Can you explain this?

Dr. VOLZ. Well, the particular study that Mr. Powner mentioned was a study from 2005 of whether we could expect the instruments would last longer than the contractual lifetime. But that's only a piece of the puzzle that we use when we calculate or we estimate the projected future life of a mission.

And one of the other pieces, which really required the expenditure of time, was with the GOES–NOP is to see how those satellites operate on orbit. This was the first flight of the Boeing 601 bus in a geostationary operation like we had for GOES–NOP. We need to see when we have satellite or a new capability on orbit time on orbit to see how it's going to operate, what its performance is going to be, are we going to see life-limiting features start to develop. So it took many years, years of watching those satellites to operate from 2006, 2008 and 2009 when they were launched to develop a confidence in the family of satellite buses so that we could then say all right, now I'm comfortable saying the projection life will be longer than it is, and that's where we came to about at this time last year.

Mr. BEYER. Thank you, Mr. Chairman.

Chairman BRIDENSTINE. I'll recognize the gentleman from Georgia, the Chairman of the Oversight Committee, Mr. Loudermilk, for five minutes.

Mr. LOUDERMILK. Thank you, Mr. Chairman.

I want to continue on with the line of questioning that my good friend, Mr. Beyer, brought up. Mr. Powner, you brought up the slides and the charts indicating the lifecycle, the launch dates, and now we're extending the lifespan and the useful life of both satellite programs. It's been extended by three years.

And Dr. Volz, you just mentioned that there was other data that was considered beyond just the 2005 documents that was provided to this Committee. One question: Why was only the 2005 document provided to this Committee when we requested data to back up why you're extending the lifespan of these satellites?

Dr. VOLZ. Well, actually, sir, in the submission, in response to the letter we received, we submitted that study but also an anal-

ysis and explanation of how we did use the on-orbit performance validation of these instruments over time and the satellites over time as one of the rationales for extension, and also what we also provide on a regular basis are monthly status reports on all of our satellites, and we provided a couple of examples of the status of every subsystem of the spacecraft that we do on a routine basis.

So while we haven't provided that, and it's a good point that Mr. Powner made, we haven't provided a regular routine mechanism or what the health is of all our satellites, and one of the observations I had to my team is that we should be doing that, so on an annual basis at least providing an update of the health of our constellations overall so we don't have a ten year cycle for updating lifetimes and we talk about it on a regular basis as part of our annual reporting.

Mr. LOUDERMILK. So are the studies that you're referencing as extensive as what was done in 2005?

Dr. VOLZ. No, the study in 2005 was a specific request to ITT, the instrument vendor who build the sounder/imager for the GOES–NOP series and the previous ones as well. The study was specifically directed to say although the instrument was designed for a particular lifetime, what does the vendor think the likelihood of that instrument lasting past, well past that lifetime. So we really had to go to the vendor who built it, who knew all the parts to say exactly what do you think analytically pre-launch these things are likely to see. So that's one piece of it. It's a very specific analysis.

The analysis I mentioned from our operations team looks at all of the operating performance of a series of satellites and watches each of those from a day-to-day, month-to-month basis and then from that develops a statistical understanding of the likelihood of continued operation of features that may show up in initial wear factors in the spacecraft that we need to understand as they age on orbit.

Mr. LOUDERMILK. So——

Dr. VOLZ. It's different kinds of studies.

Mr. LOUDERMILK. The information you provided the Committee said that increasing lifespan of the satellite by three years is plausible. Is that——

Dr. VOLZ. I think that's a reasonable way to put it, yes, sir.

Mr. LOUDERMILK. Well, the definition of plausible has actually three definitions: possibly true, believable or realistic. Which one of those is it, possibly true, believable, or realistic?

Dr. VOLZ. I'm not sure they're all mutually exclusive. I would say it's a realistic assessment based on the knowledge that they are likely to survive through this period.

Mr. LOUDERMILK. Okay. So with that, by expanding it by three years, are we increasing the likelihood that we could have a data gap?

Dr. VOLZ. Relying on aging assets for a longer period of time is a riskier approach than I would like to take for sure, sir. I would prefer to have GOES–R up there in March of 2016 as opposed to October of 2016.

Mr. LOUDERMILK. We want it to be a GOES–R, not a ghost.

Dr. VOLZ. Yes, but I would also want it to be a GOES–R that's functioning and capable and tested out and not GOES–R that is rushed so that it may have failures or it may have shortcomings or testing incompleteness that we had to do in order to get it to launch.

Mr. LOUDERMILK. I fully concur.

Mr. Powner, would you like to weigh in on the feasibility? Are we increasing the possibility of a data gap?

Mr. POWNER. Well, clearly, there's the gap on the GOES constellation, the geostationary constellation. The potential for a gap in backup capability is—you can see it from the chart there. There's a likelihood that we're going to have that situation. I think the key with the extension of these lifespans, NOAA needs to have a very clear policy on how they evaluate these constellations. I know we start with design lives and then we evaluate the reliability and availability of the constellation through detailed analysis. On JPSS, they do a very good job, okay. We have an annual update. On GOES, we don't see it. So I think there ought to be some consistency here because when you start moving these lifespans, it really affects the timing of when we build and launch these future satellites, and we all know these two programs consume a large part of NOAA's budget. Maybe you could slow those down in out years and budget could be used for other things. I'm not saying that these aren't important; they are. But there's implications to moving these lifespans out. You can't just move them out and say build them as quick as we have with the original plan.

Mr. LOUDERMILK. Mr. Chairman, I see my time is up. I just would like to add that, you know, fiscal responsibility, efficiency, taking care of taxpayer money is very important, but we're talking about an issue that can deal with the safety and the lives of others. So I yield.

Chairman BRIDENSTINE. I'd like to thank the Chairman.

For Dr. Volz, we understand you've been doing this job now for just over a year. These challenges have been developing over time, and we know you're working really hard to make sure that these issues are addressed. From our perspective, I'll just be real quick before I hand it over to Mr. Bera, from our perspective, we learn that there's going to be a delay in launch for GOES–R, and at the same time we learn that we're going to extend the life of another satellite. We're going to predict that it's going to last longer, and it looks like it could be intentional that we're just extending is to that we can get to the next launch, and I'm not saying that's what happened. I'm saying that as Mr. Powner said, if there was more transparency, if we knew that well ahead of time, it wouldn't have appeared this way. So just—I'm sharing my sentiments on that. So transparency helps us, and we want to help you.

So I turn it over to my friend from California, Mr. Bera.

Mr. BERA. Thank you, Mr. Chairman, and I thank the Ranking Member.

You know, when I think about weather forecasting, thinking about this with my district, state, and much of the American West in mind because we're going through a devastating drought right now, and it's the fourth year of historic and unprecedented drought. When I think about my district, you know, Folsom Lake,

which supplies drinking water for, you know, close to half a million people in my region, it's a historic low right now. So just having the predictability of weather is going to be incredibly important because again, in California and in Sacramento, we have this dual risk. We have years where we have incredibly high flood risk and then obviously now we're living through this drought. So better forecasting allows us to better manage a precious asset: water.

And you know, that's why I share the concern of my colleagues here. If there is a gap in that ability, that does put us at risk, it puts the Nation at risk and, you know, it really does make it difficult to manage.

I'm going to shift a little bit. If in fact there is a gap, we know there's commercial weather satellites out there that are providing commercial data. Is that true, Dr. Volz?

Dr. VOLZ. I don't know if any commercial assets that are providing equivalent data and observations to the nature of what we provide that support our weather services. So there may be specific measurements that might be available, but in general, there are no commercial assets of equivalent or capable nature.

Mr. BERA. So there's no commercial backup that would be available.

NOAA's data that comes from GOES and the other satellites, that's publicly available to anyone who wants it, or is that still——

Dr. VOLZ. Correct.

Mr. BERA. So it's a public asset?

Dr. VOLZ. Correct, sir.

Mr. BERA. That's available to anyone around the world?

Dr. VOLZ. Correct, just as other nations' assets and measurements are available and to others as well. It's a global cooperation and sharing agreement on the observations for weather and climate.

Mr. BERA. And you'd consider that really would be a critical public asset for the common good?

Dr. VOLZ. Yes, sir, entirely so.

Mr. BERA. If we think about commercialization then, and this data—so if we were to shift from, you know, a public expenditure for the common good to more commercialization of this data, is there a risk that, k, that's no longer available, you folks have to pay, subscribe et cetera? Is that going to——

Dr. VOLZ. There is a perception. The approach that NOAA has, that we have, is that weather services that we provide, for the observations that feed those are a public good and are necessary for health, safety and security for the Nation and for our citizens, so the idea of commercial available data sets are not necessarily at odds with public services provided by NOAA if we can find the right terms and conditions for which to work with the commercial side to use their data in our models, in our operations.

Now, data which is restricted, which are only available to individuals, are not something that would be consistent with that approach. It's not something we would support. It doesn't mean commercial vendors can't make observations and sell it any way they want. That's fine. That's certainly open to anybody.

Mr. BERA. But again, from my perspective, there is some concern that if we're taking the taxpayer assets and then, you know, con-

tracting that out to commercial vendors to replace some of the work that NOAA's doing, you, over time, can lose the ability of this public good, this common good data set, and I don't know if that's a concern that, you know, folks at NOAA have.

Dr. VOLZ. That would definitely be a concern. If our ability to deliver on the services and the observations that are necessary for health and safety and for aviation safety and all the other operations that we do is restricted because the funds are diverted to a different approach, which is proprietary and controlled in a different way, that would be a negative approach that we would not support, and I don't support it.

Mr. BERA. And knowing that, you know, when we look at space exploration, you know, there's, you know, what is ongoing both at NASA and, you know, what we're talking about here in NOAA, this public-private partnership that is emerging, if you're kind of forecasting where weather forecasting—a little oxymoron there. But if we're predicting where weather forecasting is going, where do you see this commercial public-private partnership in the near future?

Dr. VOLZ. Well, similar to what you referenced on the NASA side, there are features, there are capabilities that we already rely on heavily on the commercial side to provide. For the most part, we don't build our own launch vehicles. Commercial does that. For the most part, we don't build our own spacecraft. We go to commercial vendors for that. All the instruments we buy are from commercial vendors. So there's an extensive public-private engagement in the execution of our weather services. What we're talking about is the potential next step, which is to secure data as opposed to capabilities that we deploy, and I think there is an opportunity for us to do that in a way which doesn't sacrifice those public goods that I mentioned a few moments ago. So I think as the commercial sector becomes more capable and is able to deliver a more quality product, a data product, I think there's certainly a possibility for strong engagement that can fit within our business model and can support our commercial sector better.

Mr. BERA. Great. Thank you.

I'll yield back.

Chairman BRIDENSTINE. I recognize the gentleman from Ohio, Mr. Johnson, for five minutes.

Mr. JOHNSON. Thank you, Mr. Chairman, and gentlemen, thank you for being here with us this morning.

Dr. Volz, how many of the viable U.S. commercial providers for satellite data do you intend to bring under contract in the next three to five years?

Dr. VOLZ. That's a very open-ended question. It depends on resources, it depends on how many actually apply if we go out with an RFP or a——

Mr. JOHNSON. How many do you need to bring under? How many do you want to bring under?

Dr. VOLZ. I'm more concerned with getting a data flow, to getting the operational data I need. If we go through with an approach, a pilot approach, and we find one vendor that has the quality set of information that we need, that we can use, that meets our criteria, that is financially viable, that's a satisfactory result for me. If I get three to four competing and they're all providing something that I

can afford to support several, because I need the data from several, I can support that as well subject to availability of funds and the cost points on these vendors.

Mr. JOHNSON. Okay. Has NOAA done a cost-benefit analysis of gap mitigation alternatives to determine which ones are likely to be the most effective and worthy of investment?

Dr. VOLZ. When we went through the gap analysis and the exercises in 2011, 2012 and 2013, we had a report called the Riverside Report, which I imagine you've already read, which identified a number of mitigation approaches to lessen the impact of loss of a major asset. We selected a number of those to complete. We have been executing on those mitigation approaches. We did not do an allocation of "1" through "N" to say which is the most effective and least effective but we saw they applied to different areas of our observing system and we applied the ones that were possible to impact, to effect, and we have been working on those.

Mr. JOHNSON. Why do you not see the need to do the mitigation to look at the most effective?

Dr. VOLZ. I would say that we did that in, I wouldn't say ad hoc, but in a best-effort approach. It's hard to do an assessment of a particular measurement and what's the benefit of that to an integrated global model which relies on multiple inputs to say. So I would say probably the difficulty of doing a cost-benefit analysis when the output is the value of a weather product which, you know, three to five, three to seven day forecasts, it's very hard to quantify the value of that from a cost approach. We do look at the efficacy of those approaches: is it a necessary part to address a particular measurement capability, and we did prioritize. We put our effort and our attempts into working on those more importantly.

Mr. JOHNSON. Sure. As a general aviation pilot myself, I can tell you that the accuracy of that data and the ability to look out and get those accurate forecasts both near term and long term are important.

Have any studies been performed on the cost, benefits and tradeoffs between different potential launch dates for the later satellites such as GOES–U or for JPSS, JPSS–3?

Dr. VOLZ. Yes, sir, and that points to the excellent point that Mr. Powner brought up is that what we can do in the latter years once we get to a robust state, which is accomplished by getting GOES–R and GOES–S launched. Do we have to launch GOES–T and U on a rapid time frame? And the answer is probably not. We would launch on need at some point when we get to that.

So we've looked at—there are two comparisons here. One is the cost of storage if we build and then store, and the other is, the cost impacts of delaying the development, and we have done the assessments, and based on industry assessments and industry models of the efficiency of building four in a rapid sequence is more effective in terms of buying the parts and getting the workforce engaged and buying down the risk of the implementation than building one, waiting a few years, building a second, and building a third. So we actually have seen the examples from aerospace and from other industry examples of the efficiency of building first, launch later if necessary has a certain cost benefit from the build and development cycle and a significant risk benefit because you buy down the

risk by building them all at the same time when you have the parts and the availability and the engineering.

Mr. JOHNSON. Okay. All right.

Earlier this year, your office hosted a community engagement workshop to inform outside groups and the commercial sector of progress NOAA has made through incorporating commercial technologies, and this week you hosted another such event. What updates occurred between the previous workshop held in April and the one this week? What did you learn?

Dr. VOLZ. In the April workshop, we talked mostly about principles, about the engagement desires, what we would like to do going into the future. In the workshop we had just this week, we spent a great deal of time talking about the actual process by which we would use data, how data are used from observation to services and products so that we were very clear, very articulate in trying to explain—well, discern how articulate it was, depending on the feedback—to explain how the data are used in our systems and how different vendors can tailor their business models to deliver data to us at different places in our value chain.

Mr. JOHNSON. Okay. Are you talking to individual companies as well to get a broader perspective?

Dr. VOLZ. We have gone out with RFIs asking for inputs on particular measurement types. We've gone out with RFIs recently just in August about technology, next-generation technology approaches that they think are worthy of investment or are ready for application, ready for prime time as operational. In terms of the overall engagement, we have talked on a one-on-one basis, I have not, but some of my staff has, on where they—keeping us informed on where they are in the development cycle and where we are in our process cycle. In general, I'm trying to talk to them all at once so we have these workshops on a regular basis so they all see, everybody can see where we are as we move forward.

Mr. JOHNSON. Okay. All right.

Mr. Chairman, yield back.

Chairman BRIDENSTINE. I now recognize the weather guru from California, Mr. Perlmutter, but I would warn the witnesses that his——

Mr. PERLMUTTER. Colorado. Colorado.

Chairman BRIDENSTINE. Colorado.

Mr. PERLMUTTER. Colorado.

Chairman BRIDENSTINE. From Colorado. I would warn the witnesses that his jacket is off and his sleeves are rolled up.

Mr. PERLMUTTER. Thank you, Mr. Chairman, and thanks for holding this Committee hearing, and to you two gentlemen, thank you for being here again. These are very important assets of the United States, as Mr. Loudermilk said, you know, dealing with life, limb and property as well as science, and, you know, I think I mentioned the last time you were here, I've been working on this since 2009 and 2010 with NPOESS, and what I'd like to do is just sort of go back to basics and understand the structure, the decision-making structure here.

So I come from a construction family, and with respect to JPSS and the GOES systems, am I correct when I look at it as NOAA is the owner, NASA is sort of the general contractor, and then the

private companies, the Lockheed's, the Ball's, the Orbital ATK's are in effect the subcontractors? Is that a fair way to describe this? And this is to both of you. So Dr. Volz?

Dr. VOLZ. Yes, except that I'd add a nuance there. Yes, NOAA is the owner but NOAA's also the architect. So the architect doesn't just give the plans and walk away. The architect is there with the general contractor and is there when the general contractor sometimes is talking to his subcontractors to make sure that what he had in mind in the architecture is what is actually being implemented. So that's the role NOAA plays. We do not have the engineering depth that NASA does and we rely on that depth, but we are there with the requirements, with the user community interfaces so that we know what the end use is of every one of these observations, which allows us then to work hand in glove with NASA and with the major contractors to make sure that end use is remembered, is kept in mind as you go through the whole development process.

Mr. PERLMUTTER. Mr. Powner?

Mr. POWNER. Yeah, and I would just add that the contracting situation with the spacecraft, each sensor and the ground component, they all have prime contractors with subs. So you have many contractors and subcontractors involved with each of those many components.

Mr. PERLMUTTER. Well, the reason I'm asking that question is because whether it was NPOESS or now GOES and JPSS, there is a little separation between NOAA as the owner/architect, if you will, and the general contractor, NASA. Before it was NOAA and the Air Force. And we've had—I mean, obviously we wouldn't be here if we weren't having some delays and some hiccups in how these things are proceeding, and sometimes I feel like NOAA, you know, gets hammered when in fact it's really been either the Air Force or NASA that has caused some of the hiccups, and they're not sitting here today. Am I mistaken in that at all?

Dr. VOLZ. We can go too far with the analogy between NPOESS and where we are now. I believe in the NPOESS days, there was a greater separation between the different owners and executors of the program, which led to some of the disconnect, some of the problems. The requirements flow-down into the implementation was much more complex under NPOESS than it is now.

I believe now with the NASA–NOAA relationship and the NASA–NOAA contractor relationship that we have on JPSS and on GOES–R, we have a much better connectivity across that line. There are leads and follows but it's much better than it has been in the past.

Mr. PERLMUTTER. Well, let me tell you where I'm going with this because I'll run out of time.

You know, as a Coloradan, we were disappointed when Ball didn't get the follow-ons in the JPSS program. NASA was the acquisition point person or point agency, and obviously the contractor there. What I'm concerned about is just as Mr. Powner was saying, you know, the Navy has a very good system of building submarines. You know, they really do have an assembly-line approach. And given the fact that we've had these delays, Dr. Volz, more to you but also to Mr. Powner, I mean, shouldn't we be trying to do

something like that with these satellites so that you can get them done in a way that's timely, that's well tested? Am I making a mistake here?

Dr. VOLZ. No, I think you have a perfect example between GOES–R and JPSS in that if you're building a series, a fleet, it does make sense to define the requirements once and do the implementation once, and that's where we are right now. That's how we set it up with the program with the GOES program. You still have problems, and we're talking about. That's why we're here because of the issues in the development of the GOES–R program but we hope that we'll work through those and overcome them. With the JPSS, the Suomi NPP JPSS program, we did not have that same construct. We were building them one at a time and there are definitely significant inefficiencies in doing it that way whether it's an intentional change in a major subcontract like the spacecraft from Ball Aerospace or Orbital ATK or it's an unintentional change because the work—the production lines have changed and the capabilities, the subcontractors change out and you can't control it. So by going with the one-at-a-time approach, you definitely are setting yourselves up for a more risky approach, which is one of the reasons the PFO, the follow-on to JPSS, is intended to be buy both at once, eliminate those risks of coming with multiple serial buys so that you do minimize the risk of implementation. And I'll let David answer too.

Mr. POWNER. We've had a lot of risks and delays on both these programs. I don't know why you'd add more risk with the—that was our point on J–2, and especially when we sat down on GOES and the delays and we said okay, well, what's going to be different with your schedule performance, and they said well, we learned a lot, okay, in the second one we're going to be a lot better at it. Well, don't you—that logic probably applies to J–2. There's a lot of issues on J–1, work-arounds with subcontractors and the whole bit, and Ball Aerospace can lay out all those things. A new contractor doesn't have all that history going forward so we think there is risk with that shift, and we're looking for more continuity where we kind of get an assembly line here.

Mr. PERLMUTTER. All right. Thank you.

Thank you, Mr. Chair.

Chairman BRIDENSTINE. I'd like to thank the gentleman from Colorado.

I recognize the gentleman from Texas, Mr. Babin.

Mr. BABIN. Yes, sir. Thank you, Mr. Chairman, and thank you to our witnesses.

Dr. Volz, if the government has weather or climate missions that you could catch a ride on a commercial satellite to the benefit of all parties, it would seem to me to be a cost-effective and sustainable option. Has NOAA taken advantage of these hosted payload options for weather or climate missions? If so, why or why not?

Dr. VOLZ. You're correct. If we can find a ride,and that meets our requirements, it's an appropriate and potentially more efficient way to do it. We are suggesting and proposing that approach for our search-and-rescue and A–DCS systems—it's called CDARS which would use the Air Force's hosted payload solutions approach for

buying space, spare space on commercial launch vehicles, or commercial spacecraft, not just launch vehicles, yes.

Mr. BABIN. Sure. Okay. Thank you.

And again, since the President's fiscal year 2016 budget request transfers responsibility for developing climate instruments and climate satellites from NOAA to NASA, will NOAA funds that were meant to pay for such instruments and satellites stay within NOAA for use in gap mitigation efforts or will they be transferred to NASA to offset the cost of their development? And what effect would such development have on NASA's budget? Please provide the Committee with a funding breakout of how this arrangement would look.

Dr. VOLZ. So I'll be happy to provide you with a follow-up on the funding breakout.

From looking at the transition of the couple of measurements from NOAA to NASA,there were no funds transferred from NOAA to NASA, there were no funds allocated. We were underfunded to execute those activities on the NOAA side. It was a prioritization question. And the concern was, they would have been left off the table entirely because they weren't funded from the NOAA side. It wasn't that we had funds that we should then move over to cover it somewhere else. So it was both a question of focus and let NASA do the climate but also an inability on our side to support those programs because we had to support the primary weather mission that was our focus.

Mr. BABIN. Okay. Then Mr. Powner, you seem to have major concerns about NOAA's transparency and openness with Congress. What are the key issues that drive your concerns here?

Mr. POWNER. So we had a hearing in February on these two programs, and then what happened was, the lifespan extension occurred in April. The fly-out charts changed in April. And we think if a major change occurs like that, this Committee should have been informed. That's one example.

Mr. BABIN. Okay.

Mr. POWNER. Another example is, I think the schedule performance could have been disclosed much more directly and openly to this Committee when we had that hearing in February.

Mr. BABIN. Absolutely.

Mr. Volz, would you like to comment on that?

Dr. VOLZ. Sure. On the first one, the fly-out chart change, that's on me. As I came in from NASA, I remember looking at the fly-out charts over the years and trying to understand, you know, what the logic was in those, and I brought in with my experience there are different analyses, different approaches to assessing the extended life since I've done that for many years at NASA that would be applicable, I thought, to these systems and these programs, and that's what I asked for. It was my error not knowing how sensitive it was, how important it was that we communicate those. So we will, as I said, we will make that a regular thing in the future.

On the other question, which I'm drawing a blank—what was the second one?

Mr. BABIN. Schedule performance.

Dr. VOLZ. On the schedule performance, that's a fair point, and to the degree that we're not communicating well, quantifying the risks that we see in the execution of these programs, I think we need to do a better job of that. We work regularly with your staffers, with the Committee, with our quarterly briefings, and to the degree that those are not communicating appropriately, I'm happy to find a better way to do that, to improve that communication.

Mr. BABIN. Okay. And once again, Mr. Powner, one of NOAA's challenges is that it needs to obtain more and better weather data with less money. One way to do that is to buy data from the commercial sector instead of trying to launch satellites by themselves, but NOAA satellite division, NESDIS, has also been delegated the authority granted by Congress to the Secretary of Commerce to regulate these new commercial providers, and they're having trouble granting licenses on a timely basis. Isn't it a conflict of interest for a bureaucracy to regulate the industry that is competing with its traditional satellite programs, and should the authority to regulate and promote this new innovative and money-saving industry be moved to the Office of the Under Secretary for Oceans and Atmosphere instead of being buried inside NESDIS?

Mr. POWNER. Yes, that's—in terms of where that should reside, I think the key point here is this: We need robust constellations for both GOES and JPSS. We're always going to have NOAA own and operate these big satellite programs. That's not going to go away. But we need to supplement these constellations with commercial data to ensure that we have a robust constellation. So I think where everyone wants to go with the use of commercial products and the like, we need to look strongly at that to build the most robust constellation. That's what's most important for the American taxpayer in this country.

Mr. BABIN. Absolutely. Okay.

Thank you, and I yield back, Mr. Chairman.

Chairman BRIDENSTINE. The gentleman yields back.

I now recognize the gentleman from Florida, Mr. Posey, for five minutes.

Mr. POSEY. Thank you, Mr. Chairman.

Dr. Volz, in your opinion, how likely is GOES to meet its launch date of October of 2016?

Dr. VOLZ. I think our current performance and the scheduled execution is strong. We definitely have margin against our August delivery date to the launch site. The poor performance that was mentioned by Mr. Powner in the two years leading up to the thermal vacuum test in July and August is real, and following then, when we reestablished this schedule for an October launch date, we provided a new schedule approach for Lockheed Martin and for NASA and for NOAA to work together. Since then, since the September, October, November period, as opposed to 10 days a month of reserve being used up, they are ahead of schedule. So the way that we have rephrased the schedule and reframed it with reserve appropriately has been working, and the program is working on schedule since that time in the face of problems and issues like we typically see during integration and tests. So I'm reasonably confident that we will meet the October launch date.

Mr. POSEY. Okay. Thank you.

Mr. Powner, do you see that the same way?

Mr. POWNER. Well, we are aware of, there's some failed transistor parts that affect battery operation and the whole like. I think that's been a key risk going forward that we have heard that that October launch date possibly could be at risk. That's a key issue. I don't know where we're at on that right now but that's something that we're watching. We're still cautiously optimistic on these launch dates going forward because we've heard indicators that there's still some risk to the October 2016 date.

Mr. POSEY. Okay. Well, you partially answered my next question for Dr. Volz, and that is, what do you see as the biggest factors that could cost another launch delay?

Dr. VOLZ. We still have some mechanical and environmental testing ahead of us, and the likely factors on the GOES–R spacecraft since it has been integrated and the particular transistor failure in the power-regulating unit has been corrected and the pieces are back in integration, is the nature of similar things like that happening that could be a bigger problem that takes time to resolve—a parts problem, a mechanical problem during tests. Those are still ahead of us, so until we get through the mechanical testing, the vibration testing, acoustic testing, those are major tests that we still have to complete. The ground system is solid. The radar—the antennas are completed and ready for receipt. The user community is prepared. It's getting the spacecraft through the last 8 months of environmental testing to launch which is always a challenge but that I see as a systemic challenge that we have for the program right now.

Mr. POSEY. Okay. Thank you.

What are some of the potential impacts of a delay of GOES–R launch? You know, will it increase the lifecycle cost?

Dr. VOLZ. It will not increase the lifecycle—well, it depends on the type. If we have a major issue, you know, within the expected range of delay here or there or the operations that we have to do to execute, we are operating within the lifecycle cost budget, within the annual budgets, so I do not expect that based on what we see now that we need additional funding for the GOES–R program.

Mr. POSEY. Okay. What is the current estimated time during which GOES constellation will not have a backup satellite available?

Dr. VOLZ. That's a good segue-I don't predict that we will have any point that we won't have a backup satellite available based on our estimation of the current life expectancy of these satellites. However, we are all only one failure away from losing a satellite. That can always happen. So between now and the launch of GOES–R, our estimation is the satellites we have on orbit are functioning, aging and healthy, as I said in my introduction, and I do not expect that we will have a gap. However, if we do, if we lose one of our assets, we do have a backup in space, and if we lose that, if we're reduced to two satellites, we have anticipated this possibility and worked cooperative relationships with our international partners so that they could loan us a satellite in the dire circumstances that we have two major system failures.

Mr. POSEY. And I was going to ask, has this ever happened in the past?

Dr. VOLZ. It has in the past occurred that we have worked this with EU MET SAT in the past to borrow some assets from our foreign partners and we've contributed assets in the same as the global constellation of geostationary satellites have needed the partnership sharing arrangement that we've had, and it's been successful and it has been exercised two or three times in the past.

Mr. POSEY. We had a hearing earlier and had testimony about the sunburst that crossed our orbit last year that we missed by about one week that would have virtually, some experts say, knocked out every single commercial satellite. How would that have affected yours?

Dr. VOLZ. I don't know the magnitude of that particular solar event that might have hit us. Our satellites are hardened for what we understand what the normal environment is, normal meaning some deviation from the normal environment. A major solar storm would have an impact on all of our satellites. And "major" is hard to determine exactly what it is. But we are as vulnerable as some other satellites to major solar flare events, and we do what we can to harden it. We may be more hardened than some of the commercial ones but it's still the event—a significant event would have an impact on us.

Mr. POSEY. Mr. Powner, do you want to comment?

Mr. POWNER. I have nothing further to add on that.

Mr. POSEY. Yeah, and I'm concerned about, you know, what we do to harden these, you know, how much they can be hardened, if there's any cost that's prohibitive in doing that. I just don't think that Congress quite frankly or the public communications industry has taken that serious enough. We had experts come in here and tell us basically it would change the world as we've known it. They say the impact would be in the trillions, and they talked multiple trillions because they wouldn't even dare attempt to quantify it. But we seem to be doing so little about hardening these for the solar eruption is what they called it or EMPs. They just dismiss that as well, before somebody'd use an EMP against us, there'd have to be bigger problems, which is not true, and so is there a plan that contains NOAA's ongoing strategies to mitigate a satellite data gap?

Dr. VOLZ. Yes, sir, there is, and it's been exercised for the last several years of our program, and that is the point of getting JPSS–1 and 2 and the PFO under contract to get to a situation, and directly to your point, where we have a spare, a hot spare on orbit for our polar and geostationary satellites, and in the event of a significant event, we're thinking about a meteorite but it could be a solar flare, we can redeploy an equivalently capable asset within a year. That's the objective, and that's one way, rather than trying to harden a satellite against an unknown size of event is to have a replacement satellite that is readily available, and when you look at the GOES–T and U available, we won't necessarily launch those to have them sit in orbit. We could have them sitting on the ground for deployment in the case of an event like that as a replenishment when we have a failure.

So our programs do support getting to a robust state but we're not there yet.

Mr. POSEY. That's a great plan, but if we had an impact, the consequence of the one the scientists told us last year, it's very possible that there would not be an electronic grid to enable you to send up the replacement within a year.

Dr. VOLZ. Fair enough. The magnitude of the event is—there are events of a size that we can't model for or plan for, but we are planning for the loss of satellite assets over something that may only affect the satellites and not the whole ground infrastructure.

Mr. POSEY. Okay. Mr. Chairman, I thank you for your indulgence. I yield back.

Chairman BRIDENSTINE. Mr. Powner, would you like to address—I saw you maybe indicating you had a comment when he mentioned that the GOES–R delay could have an impact on lifecycle costs. Did you want to say something about that?

Mr. POWNER. Yeah. Well, lifecycle costs—so there are reserves, okay, and you have an overall lifecycle. Any delay, there's going to be an impact on cost. I mean, this last delay, there was an impact on cost. So I just want to be clear on that. Any delay that we further have, there will be an impact on cost and there will be an impact on the potential increase and the potential gap in backup capability.

Chairman BRIDENSTINE. That's important for those of us on this Committee to understand.

I now recognize the gentleman from Alabama, Mr. Palmer, for five minutes.

Mr. PALMER. Thank you, Mr. Chairman. I'd like to thank the witnesses.

Mr. Powner, you mentioned that NOAA needs a clear policy on what analysis should drive the adjustment of satellite lifespans. Can you expand on that and——

Mr. POWNER. So some background here. If you look at like what DOD does, they actually have very robust analysis on the availability and reliability of their operational satellites. To NOAA's credit, on JPSS, they do a pretty nice job on JPSS. They do an annual assessment on that availability and reliability. We don't see it on GOES. But even too, they just need to be real clear on what their policy is on how they determine the lifespan. So for instance, I've been doing this a long time, looking at NPOESS for this Committee even prior to some of the dates that Congressman Perlmutter made. Our understanding is that the GOES policies, you have a backup on orbit. On the polar constellation, we always thought the policy was, you have a backup on the ground but now I'm hearing a backup in orbit. We just need to be clear on what our policy is on ensuring a robust constellation, and it's—NOAA is not always clear. They're not always clear, and we need to get that clarity so that we have a robust constellation.

Mr. PALMER. Let me ask you this. How can NOAA determine that appropriate progress has been made on implementing gap mitigation activities, Mr. Powner?

Mr. POWNER. Well, you know, we looked at this with our last review when we testified in February. There's a lot of good work on mitigation activities, and I do think there are some mitigating factors that yield greater benefits. We've heard like aircraft observations, some of the adjustments to the models and the like, and

NOAA's working on those things. So a lot of that's being worked on now, and that goes back to some of the comments and questions earlier on our recommendations. We want to see some of those mitigation activities rounded out even further so that if in fact we have gaps leading up to March 2017, that we have some of these backup capabilities.

Mr. PALMER. In that regard, and Dr. Volz, you may want to comment on this, go back to Mr. Posey's question right there at the end about having—whether you've got a satellite, a backup system already in orbit or if you've got backup systems on the ground, do you have backup launch capabilities? Because if you do have a massive solar event or some other EMP-type event, would you have the capability to launch more satellites?

Dr. VOLZ. We rely on the launch services provided through the national assets, the same launch service that support—the defense department, NASA, NOAA. We all use the same commercial launch providers. In the event of a catastrophic loss of a significant asset, we also have the capability and to prioritize our mission over others, I believe, so I think if that were——

Mr. PALMER. What I'm asking is, and you may not be able to answer this if you're relying on other agencies, other parts of the government for the launch capability, but it's not just losing the asset in space, it's—if you had a catastrophic event like an EMP where your ground systems are eliminated, do you have backup systems or—you may not be able to answer this—are there backup systems that could launch, that have been hardened, that we could get in place to get something back in orbit?

Dr. VOLZ. And I'm not the right person to ask what the backup capabilities are for the launch.

Mr. PALMER. All right, Mr. Powner, I'm going to go back to you. For JPSS, your report from earlier this year focused on a potential gap in the 2015–2017 time frame. Are there similar concerns about a gap between the first and second JPSS satellites in the early 2020s?

Mr. POWNER. The first and second—we have not—we're not concerned about a gap between the first and second, assuming we hit the March date and JPSS–2 stays on board. The issue with the gap between NPP and J–1, you know, if you didn't have this recent four-year extension on the lifespan, there would be a gap. So, you know, the key here is, we hope that NPP continues to function well and we hope that J–1 does launch on March 2017 so that we don't have a gap between NPP and J–1. That's still a concern of ours. That's still a concern. Until we launch J–1, we're concerned about a gap.

Dr. VOLZ. And if I may, sir, I have almost the exact opposite assessment. Based on watching the Suomi NPP instrument and mission fly over the past four years, based on our analysis and our understanding and mitigation steps we've taken in execution of those operations, I have a stronger confidence now that the satellite, barring a meteorite or some other activity, is likely to function for a great many years because I've seen these satellites do that over time. I think the uncertainty in launch of—the gap between J–1 and J–2 is because we haven't launched J–1 yet is a larger probability of something I'm more concerned about going forward.

But we're talking about probabilities and risks, and we have to address all of these. So I don't think that once J–1 is launched that our risk of a gap has necessarily gone away. We still have to worry about getting J–2 developed and delivered on orbit as quickly as we can.

Mr. POWNER. One thing if I could add, I do think NPP overall is functioning well. It's not perfect. You can read their own availability analysis, and there's questions about ATMS lasting beyond the five-year life, not a nine-year life. So there's watch items there, and we need to continue to watch that so I don't want—there's not—we need to be real clear that there still are risks with NPP.

Mr. PALMER. Mr. Chairman, I see my time is expired.

Chairman BRIDENSTINE. I thank the gentleman from Alabama.

We're going to go into a second round of questions, and I recognize myself for five minutes.

I wanted to share with you guys some of the challenges I see going forward as it relates to the commercial data buy. The President's budget request is due to this Congress in February. We'll do a budget process in March. Then we start doing-we'll be doing authorizations along this way and appropriations even before, or I should say after. What I would be interested in is what that number might be, and I know you probably don't have that number for a line item for a commercial data buy. I want to be clear that we're expecting that, and I'd like—if you're able to provide that to us even before February, it'd be very valuable as we go through the authorizations and the appropriations processes. So just, you're under no obligation to give us anything until the President's budget request, I understand that, but if you can help, we want to be helpful as well, so that would be good.

On the NOAA Commercial Space Policy that came out on September 1st, it's been open for comments. The comment period closed October 1st. There have been 15 comments. Do you have a timeline when the final policy might be released?

Dr. VOLZ. Yes, sir, and we had 15 respondents. When we looked through the responses, we came up with on the order of 90 different actionable comments that we think should be addressed in some way or another. NOAA has set up a team and is working to review those and adjudicate those. I'm expecting, and I've been told by management within NOAA that we expect the revised policy to be coming out within a few weeks, within the coming weeks.

Chairman BRIDENSTINE. Oh, that's great.

Dr. VOLZ. And in the meantime, we've been working the process. The workshop on Monday was addressing that, and we would like to follow up with a release of a draft process for comments, just like we did with the policy, within a few weeks after the release of the formal policy.

Chairman BRIDENSTINE. So after the release of the formal policy, there will be more comments?

Dr. VOLZ. No, a draft release of the NESDIS process, which is the next level of detail down about execution of an engagement with industry.

Chairman BRIDENSTINE. Got it. And when you can—you said we can expect that a couple weeks after——

Dr. VOLZ. After the release of the NOAA policy.

Chairman BRIDENSTINE. Fantastic. So we're talking about January, February?

Dr. VOLZ. Yes.

Chairman BRIDENSTINE. Okay. Fantastic. Let's see.

I want to go through a couple of comments, or I should say statements that were made regarding the space policy, and I want to get a reaction from you on it. One statement is that—and I'll just read it. It says: "In its entirety, the latest iteration of NOAA's policy fails to make a distinction between raw satellite data that would be ingested into NOAA's operational weather models, which is the intended focus of this policy, versus the output of those models and derived data products. It is the full, free, and open access to model output, derived data products and current ground conditions that underpins the robust U.S. commercial weather sector." Do you agree there's a difference between the output and the raw data, like the satellite data coming down from the satellites?

Dr. VOLZ. Let me predicate this with saying I'm not an expert on WMO–40, which talks about the essential versus non-essential or additional data sets, and they address mostly the issue of the data. There is a difference between input data and output products for certain, no question about that. So a simple answer to your question is yes, there is a difference between those, and I don't know that the policy was meaning to address the output products, the output services as they are free and open to all.

Chairman BRIDENSTINE. Okay.

Dr. VOLZ. But it is focused on, from my perspective in using commercial data in our operations, is how we deal with the data that we receive from the vendors, which is the input data that you're referring to.

Chairman BRIDENSTINE. So going back to your mention of the WMO–40, there's another statement here. It says, "WMO–40 resolutions 40 and 25 explicitly permit private-sector companies to restrict the redistribution of their data and allow those same member countries flexibility and discretion in determining which data sets are freely exchanged and under what conditions they choose to do so." So it looks to me like under WMO–40, private industry that is providing data to augment the numerical weather models, that data should be protected. Would you like to make a comment on that?

Dr. VOLZ. Probably not. I am not——

Chairman BRIDENSTINE. Probably not, you don't——

Dr. VOLZ. I'm not a WMO–40 expert——

Chairman BRIDENSTINE. Okay.

Dr. VOLZ. —so I don't know all the nuances of it. So certainly—so I probably should let it go at that, and we'd be happy to have a different, separate conversation related to WMO–40.

Chairman BRIDENSTINE. I'd like to get, you know, these kind of resolutions in this final space policy coming from NOAA, Commercial Space Policy, and I know it's going to be in a couple of weeks but these are the kind of things that absolutely must be definitely determined before—if we're going to have a robust commercial segment that can augment our numerical weather models and save money for the taxpayers, and that's my concern: more data, better

data, and cost savings to the taxpayer. And I think we can do that but we've got to be really clear about what's required here.

I've got about—well, I'm out of time. So I'm going to stop now and recognize the gentleman from Virginia, Mr. Beyer.

Mr. BEYER. Thank you, Mr. Chairman.

And Dr. Volz, in Mr. Powner's testimony, he talked about how the delivery one of the satellite's critical instruments, the ATMS, Advanced Technology Microwave Sounder, had been delayed, but in the last quarterly update that this Committee received, NOAA said that it had to be delivered by the end of November to maintain the JPSS–1 launch date. And your testimony now, you say that you can maintain that launch date despite the fact that the ATMS won't be delivered until the end of December. Can you explain the conflict?

Dr. VOLZ. The ATMS delivery date per the plan that we established in the summer was no later than the end of November to support the plan going forward to a December 2016 launch date, correct. The ATMS has slipped to now late December and potentially early January, and we have had to look into what we have had to take time out of reserve, schedule reserve. The late November date was planned for and did not encumber any of the reserve, the schedule reserve left in the schedule beyond the November. We had to debit against those reserves to accommodate the late delivery of the ATMS.

Mr. BEYER. You had flexibility——

Dr. VOLZ. We still had some flexibility. It wasn't a no-reserve date for delivery in November. We have flexibility. We've been using it.

Mr. BEYER. Great. In your testimony, Dr., you talked about that the GOES–R team is applying all the lessons learned from the last two years to do timely and successful completion of GOES–S, T, U satellites. Does the same theory work with the JPSS? Because I know you've now moved to a new contractor for JPSS–2. Any risks because you're not building with the old contractor on what you learned doing that?

Dr. VOLZ. Yes. I mean, I agree with Mr. Powner that going to a new contractor—so let me go two points. First, what I said is, we're applying the lessons learned over the last two years in the integration tests at GOES–R to make sure that the schedule we have laid out through this time next year, October of next year for the launch, includes those lessons learned, and that's why we have confidence based on the last 3 months that we're meeting schedules. We still need to revisit what that means for the GOES–S, T and U schedules as we roll through that, and we're doing that right now.

Now, as far as changes in the contractor, going from one spacecraft vendor to another for the JPSS, that does increase risk. That's a factor. That's a risk factor now that we've added to the system. It was not there before. And I agree with you that it does. You can't say that's not the case.

Now, whether and where that ranks in the overall risks of different risks within the program including cost and schedule risk is something we had to look at when we made the procurements when we went through the process. So it is an increase in risk but

not necessarily an increase in the overall programmatic execution risk because we have to look at many factors when we consider program risk.

Mr. BEYER. So clearly, when you made the new award, it was understanding that this was a piece of the overall puzzle?

Dr. VOLZ. Correct, sir.

Mr. BEYER. Mr. Powner, you said the very attractive idea that perhaps Congress could reduce its expenditures in upcoming years. Can you expand on that a little?

Mr. POWNER. Well, clearly when you look at the out years satellites, the follow-on for the polar constellation and then when you get into the out year GOES, there's a question about what's the most economical way to go forward. Do you build everything as quickly as you can get and get economies of scale there and perhaps store them on the ground? Perhaps. Do you perhaps slow down the acquisition of some of those out year satellites? Perhaps. And I think what—and I know this Committee, we've worked with both your staff and the Majority staff. They're looking for analysis. There was a comment made that Congressman Johnson asked a question about this, about tradeoff assessments. I'm not aware of those tradeoffs assessments that have satisfied your staff on this Committee. I think they need those tradeoff assessments to make the right decisions on out year deliveries.

Mr. BEYER. Great. Thank you.

Dr. Volz, did you have any comments?

Dr. VOLZ. Yeah, I would like to respond to that, and I agree entirely that the out year execution needs to be addressed. What we have focused our activities on over the last five years as we came to the assessment of risk on both the polar and geostationary satellites, is that we did not have a robust configuration on orbit. Our first and overriding priority was to get to a situation where we were fault-tolerant. We had a single fault—you know, we could suffer the loss of a satellite asset and not disable the weather system, and so that has dictated the aggressive approach to building the GOES–R satellites and our aggressive schedule so that as we went through what could be a mission-ending failure. The same with the JPSS. So that has been our primary motivation. Once we get to that—where we're comfortable in that risk-tolerant or fault-tolerant situation on orbit exactly as Mr. Powner mentioned, we can look at what is the cadence that we need to launch, but we need to have the assets available to have the flexibility of making those choices. Until we have that, then we can't do anything to make it better or worse.

Mr. BEYER. Thank you very much.

Mr. Chairman, I yield back.

Chairman BRIDENSTINE. I'd like to thank the Ranking Member, and in closing—oh, very good to see you down there. I recognize the gentleman from Alabama, Mr. Palmer, for five minutes.

Mr. PALMER. Mr. Chairman, thank you for recognizing me. I'm trying to do my job.

Chairman BRIDENSTINE. What the taxpayers in Alabama expect.

Mr. PALMER. Exactly.

Mr. Volz, the President's budget requested $380 million for the Polar Follow-on program. Having seen the cost overruns and delays

faced by the current satellites, I think maybe you can understand our hesitation to fully—or some of us, our hesitation to fully support fully funding this program. How exactly are these funds going to be used?

Dr. VOLZ. Thank you for the question, sir. The Polar Follow-on includes the third and fourth series of the JPSS satellites. The funds for this, the initial $380 million, are primarily to start, and to the extent of about 85 percent of those going directly to the instrument providers who have built the instruments for Suomi NPP and JPSS–1 and 2. The benefit of this approach that we tried to articulate is that we are buying the satellite instruments, which are the highest risk, potentially the highest, the most impactful elements of any satellite system, at a time, at a bulk buy or buying two at once, maximizing the efficiency of the procurement at a time when the instrument vendors are ready to build those, having just finished the same instruments on JPSS–2.

So the money will be going to the extent of 85 percent of it or 90 or thereabouts directly to the main four vendors who are supplying instruments for the JPSS–3 and 4 satellites.

Mr. PALMER. Are those vendors building the components that you think are most crucial?

Dr. VOLZ. They will be prioritizing——

Mr. PALMER. That's 85 percent of the money, so the majority of the money's going to that?

Dr. VOLZ. Yes, sir.

Mr. PALMER. All right. Let me ask you one other question, or I'll ask one other question, Mr. Powner. In GAO's opinion, would NOAA incur higher costs if they did not receive all of the requested funds to initiate the polar follow-on programs?

Mr. POWNER. I'm not certain. This is back to where the appropriate analysis and the tradeoff assessment needs to be given to this Committee, to GAO so that we can actually answer that question. You need analysis that supports it.

Mr. PALMER. To close this, and I assume this will close the hearing, I just think, you know, handing NOAA another blank check to build satellites whenever they—when they can't get the ones that they have off the ground it appears a bit irresponsible, Mr. Chairman, and I think NOAA needs to fix their systematic problems that have plagued the program for years before we throw any more money at it.

I yield the balance of my time.

Chairman BRIDENSTINE. I'd like to thank the gentleman from Alabama.

It is—it's a very challenging issue that, you know, we have delays, we have these challenges, and it seems the only answer is more money, more time, more money, more time, and if we don't provide it, then we have, you know, quite frankly, even bigger problems with data gaps and the inability to predict weather. So it puts us here in Congress in a tough position when we have these issues.

But I want to close—you know, I really believe that we can augment a lot of these challenges with commercial data. I believe that it can reduce the cost. I believe it can prevent these kind of scenarios from even occurring if we do it right, and we might not be

there today, and I understand that. These kind of things take time. What I'm—I'm very grateful that in the next couple of weeks, you know, before the end of the year, we're going to see a final commercial space policy from NOAA and then more policies that come after that so that our, you know, private sector knows how to work with NOAA in order to provide the data that can augment our systems.

When I see that final Commercial Space Policy, I would really like to see two major things. One is that there's a difference between upstream and downstream, a difference between flat-out raw data, ones and zeros coming off of a satellite, and the downstream which are, you know, the end products that are available to the public and in the national interest. And I'd also like to see a very clear resolution that in fact WMO–40 and WMO–25 explicitly permit private-sector companies to restrict the redistribution of their data and allow those same member countries flexibility and discretion in determining which data sets are freely exchanged and under what conditions they choose to do so. I think that's important as we develop this commercial industry that is going to be good for the taxpayer, good for those of us who are trying to protect lives and property, and I think these are important issues that need to be put into the Commercial Space Policy.

With that, I want to thank our witnesses for all of your time today, thank you for the hard work that both of you do, and with that, we are adjourned.

[Whereupon, at 11:47 a.m., the Subcommittees were adjourned.]

Appendix I

Additional Material for the Record

STATEMENT SUBMITTED BY COMMITTEE RANKING MEMBER
EDDIE BERNICE JOHSNON

OPENING STATEMENT
Ranking Member Eddie Bernice Johnson

House Committee on Science, Space, and Technology
Subcommittee on Environment
Subcommittee on Oversight
"An Overview of the Nation's Weather Satellite Programs and Policies"
December 10, 2015

Thank you, Mr. Chairman, and welcome to our witnesses. I am looking forward to hearing your insights and updates on these important satellite programs – J-P-S-S and GOES-R. Since I am the last to speak, I'll be brief. These two programs will play a critical role in ensuring the continued health of our weather forecasting capability, and they both have been a key area of bipartisan oversight for the Committee.

It is important for Congress to continue to work with NOAA and NASA to ensure that these programs are fielded successfully, and as quickly, as possible to mitigate any potential gaps in satellite coverage.

Unfortunately, since their inception, both satellite programs have been plagued by management and technical challenges, and I've personally seen how the programs' cost growth has impacted the budgets of NOAA's other important activities.

After our hearing on this issue in February, I was feeling guardedly optimistic that sufficient progress was being made and that the successful launch of GOES-R was in sight. However, based on the testimony GAO will provide today, it is clear that more will need to be done to ensure the successful and timely completion of these critically important satellites. We must take all necessary steps to ensure there is not a gap in satellite coverage and our weather capabilities. American lives and livelihoods depend on it.

Thank you, Mr. Chairman and I yield back the balance of my time.

STATEMENT BY SUBCOMMITTEE ON ENVIORMENT RANKING MINORITY MEMBER
RANKING MINORITY MEMBER SUZANNE BONAMICI

OPENING STATEMENT

Ranking Member Suzanne Bonamici

House Committee on Science, Space, and Technology
Subcommittee on Environment
"An Overview of the Nation's Weather Satellite Programs and Policies"
December 10, 2015

I'd like to begin by thanking Chairman Bridenstine and Chairman Loudermilk for holding today's hearing. It's fitting that we are ending our work this session the same way we began it — by holding a hearing to examine the progress and health of our nation's weather satellites. Unfortunately, problems remain and progress has been slow.

Oversight of these critical systems and finding ways to improve weather forecasts and warnings that protect the American people and the economy from severe weather are issues on which we can successfully identify common ground. This year we have partnered to advance NOAA's weather research enterprise through the Weather Forecasting Improvement Act. This bill would improve the products and services offered by the National Weather Service — ultimately saving lives.

But we can't have accurate and timely weather forecasts unless we have high-quality and continuous data from our polar and geostationary satellites. Any loss of coverage would have very serious consequences on the capabilities of the National Weather Service.

This is important for my constituents and for every American. In fact, Northwest Oregon is currently being inundated with severe rainfall. As of December 9th, areas in the district I represent experienced up to 12 inches of rain in a three-day period. The excessive rainfall has resulted in power outages, school delays, fallen trees, flooding, severe highway damage, and rerouted transit service. I want to thank our hardworking forecasters in the Portland Weather Service Office, first responders, and emergency managers for their work monitoring and mitigating the damages of this severe weather event. These rainstorms emphasize the importance of ensuring there is not a gap in weather data.

Unfortunately, both the geostationary and polar satellite programs, GOES and JPSS, respectively have been marked by schedule delays, significant cost growth, technical performance concerns, and management challenges. And although I would prefer to hear in today's hearing that the programs are both on track and that the risks of a data gap have been sufficiently mitigated, regrettably that is not the case. Since our last hearing in February, NOAA has announced that they will delay the launch of GOES-

R from March 2016 to October 2016 and a mission critical instrument on JPSS, the Advanced Technology Microwave Sounder, has missed a key milestone — its November delivery date.

These delays are unacceptable. The stakes are too high and I cannot emphasize enough the importance of getting these programs on track to protect the American people and our economy.

We will hear testimony today from Mr. David Powner with the Government Accountability Office. He will identify some of the key risks and challenges that NOAA faces in successfully executing these critical programs, but I want to focus the remainder of my time on two areas that he will discuss in detail and that are important for Congress to consider.

First, in April of this year NOAA adjusted the life expectancy estimates for the current constellation of geostationary and polar satellites. Specifically, NOAA now expects the current geostationary satellites to remain operational for 10 years, not seven years, and that our current polar satellite, Suomi-NPP, will be operational for nine years, not five years. These adjustments in operational lifespan will significantly mitigate or eliminate any potential gap in satellite coverage.

This is a positive development, but we must make sure that these adjustments are realistic and that we remain vigilant in our oversight of NOAA.

Second, the changes to the expected lifespan of our current satellites raises important questions about the best and most cost effective way to structure the timing and development of the next-generation satellites. There is no question that NOAA needs to work expeditiously to launch GOES-R and JPSS-1 as well as GOES-S and JPSS-2, but as we consider the out years it will be important for NOAA to clearly evaluate and document the costs and benefits of various launch scenarios.

Mr. Chairman, I know you share my strong desire to ensure that the American people and industries that rely on this data have the most accurate and timely weather forecasts and warnings. Our capabilities are dependent on a robust constellation of weather satellites and I look forward to hearing from our witnesses about how we can accomplish that goal.

Thank you and I yield back the balance of my time.

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